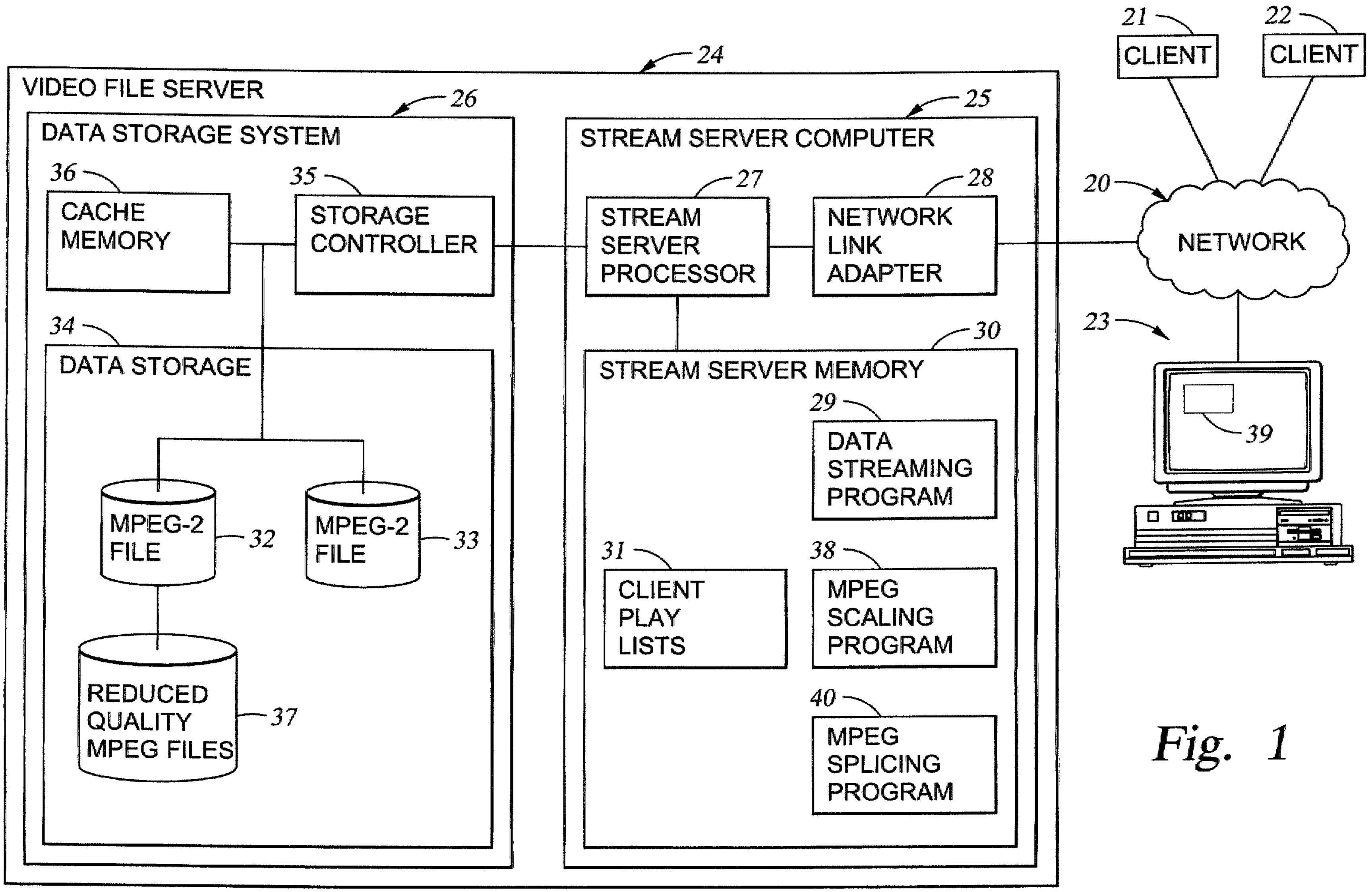
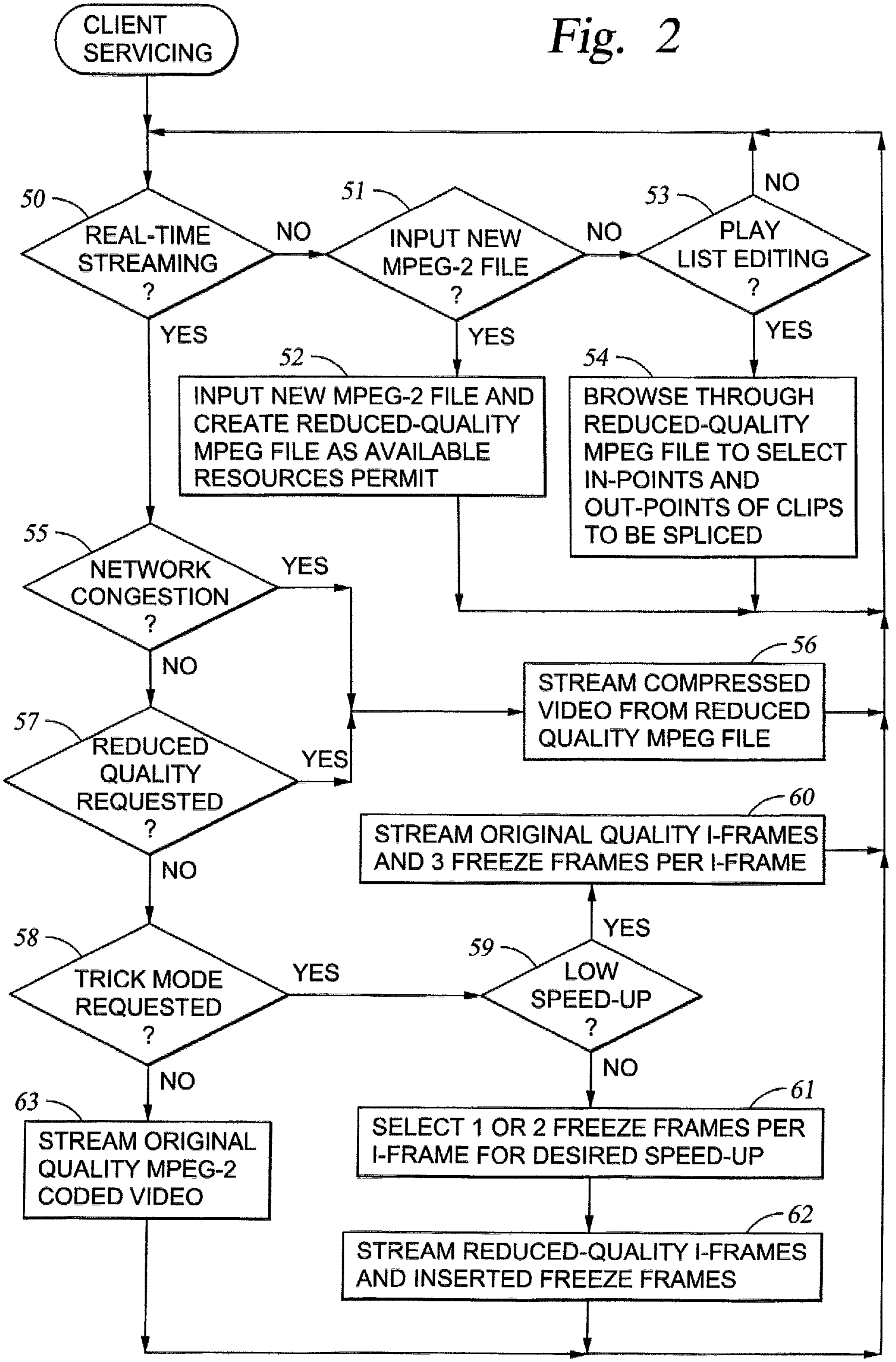

VIDEO FILE SERVER
24
DATA STORAGE SYSTEM
26
36
CACHE MEMORY
35
STORAGE CONTROLLER
34
DATA STORAGE
MPEG-2 FILE
32
MPEG-2 FILE
33
REDUCED QUALITY MPEG FILES
37
STREAM SERVER COMPUTER
25
27
STREAM SERVER PROCESSOR
28
NETWORK LINK ADAPTER
30
STREAM SERVER MEMORY
29
DATA STREAMING PROGRAM
31
CLIENT PLAY LISTS
38
MPEG SCALING PROGRAM
40
MPEG SPLICING PROGRAM
21
CLIENT
22
CLIENT
20
NETWORK
23
39

Fig. 1

Fig. 2


CLIENT SERVICING
50
REAL-TIME STREAMING ?
NO
51
INPUT NEW MPEG-2 FILE ?
NO
53
PLAY LIST EDITING ?
NO
YES
YES
YES
52
INPUT NEW MPEG-2 FILE AND CREATE REDUCED-QUALITY MPEG FILE AS AVAILABLE RESOURCES PERMIT
54
BROWSE THROUGH REDUCED-QUALITY MPEG FILE TO SELECT IN-POINTS AND OUT-POINTS OF CLIPS TO BE SPLICED
55
NETWORK CONGESTION ?
YES
NO
56
STREAM COMPRESSED VIDEO FROM REDUCED QUALITY MPEG FILE
57
REDUCED QUALITY REQUESTED ?
YES
NO
60
STREAM ORIGINAL QUALITY I-FRAMES AND 3 FREEZE FRAMES PER I-FRAME
YES
58
TRICK MODE REQUESTED ?
YES
59
LOW SPEED-UP ?
NO
NO
63
STREAM ORIGINAL QUALITY MPEG-2 CODED VIDEO
61
SELECT 1 OR 2 FREEZE FRAMES PER I-FRAME FOR DESIRED SPEED-UP
62
STREAM REDUCED-QUALITY I-FRAMES AND INSERTED FREEZE FRAMES

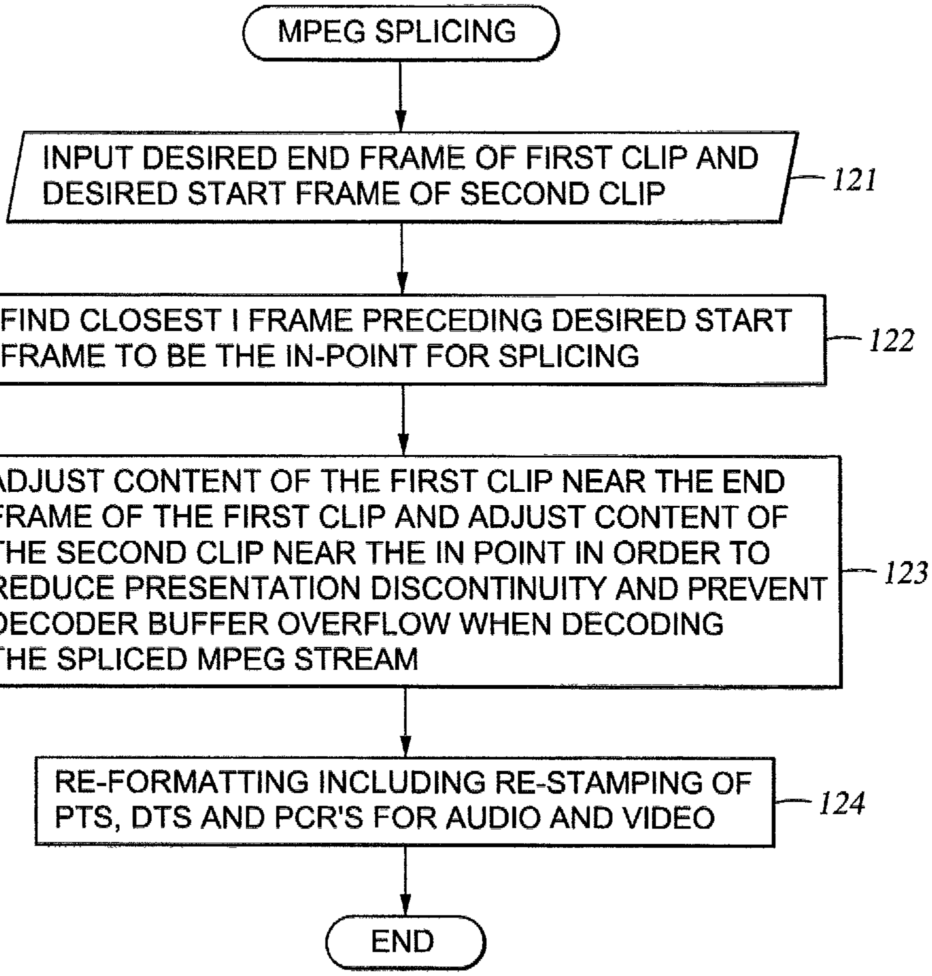
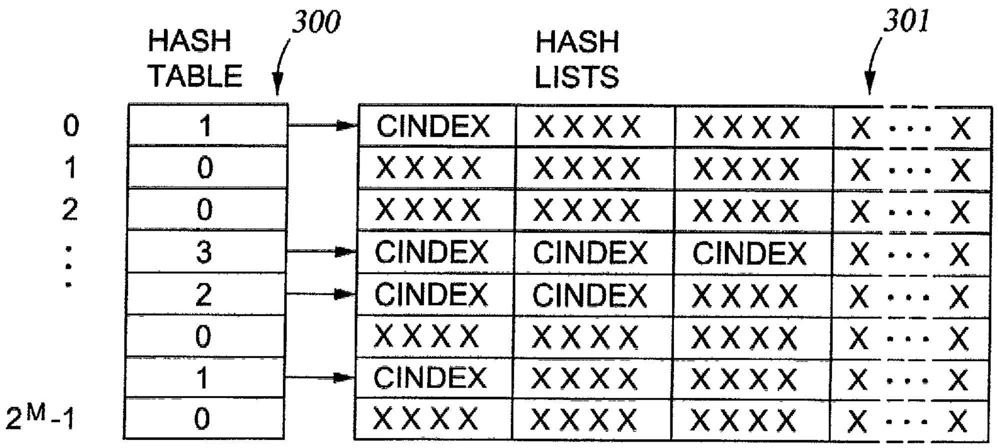


Fig. 3



	HASH TABLE	HASH LISTS			
0	1	CINDEX	XXXX	XXXX	X ··· X
1	0	XXXX	XXXX	XXXX	X ··· X
2	0	XXXX	XXXX	XXXX	X ··· X
⋮	3	CINDEX	CINDEX	CINDEX	X ··· X
	2	CINDEX	CINDEX	XXXX	X ··· X
	0	XXXX	XXXX	XXXX	X ··· X
	1	CINDEX	XXXX	XXXX	X ··· X
2^M-1	0	XXXX	XXXX	XXXX	X ··· X

Fig. 18

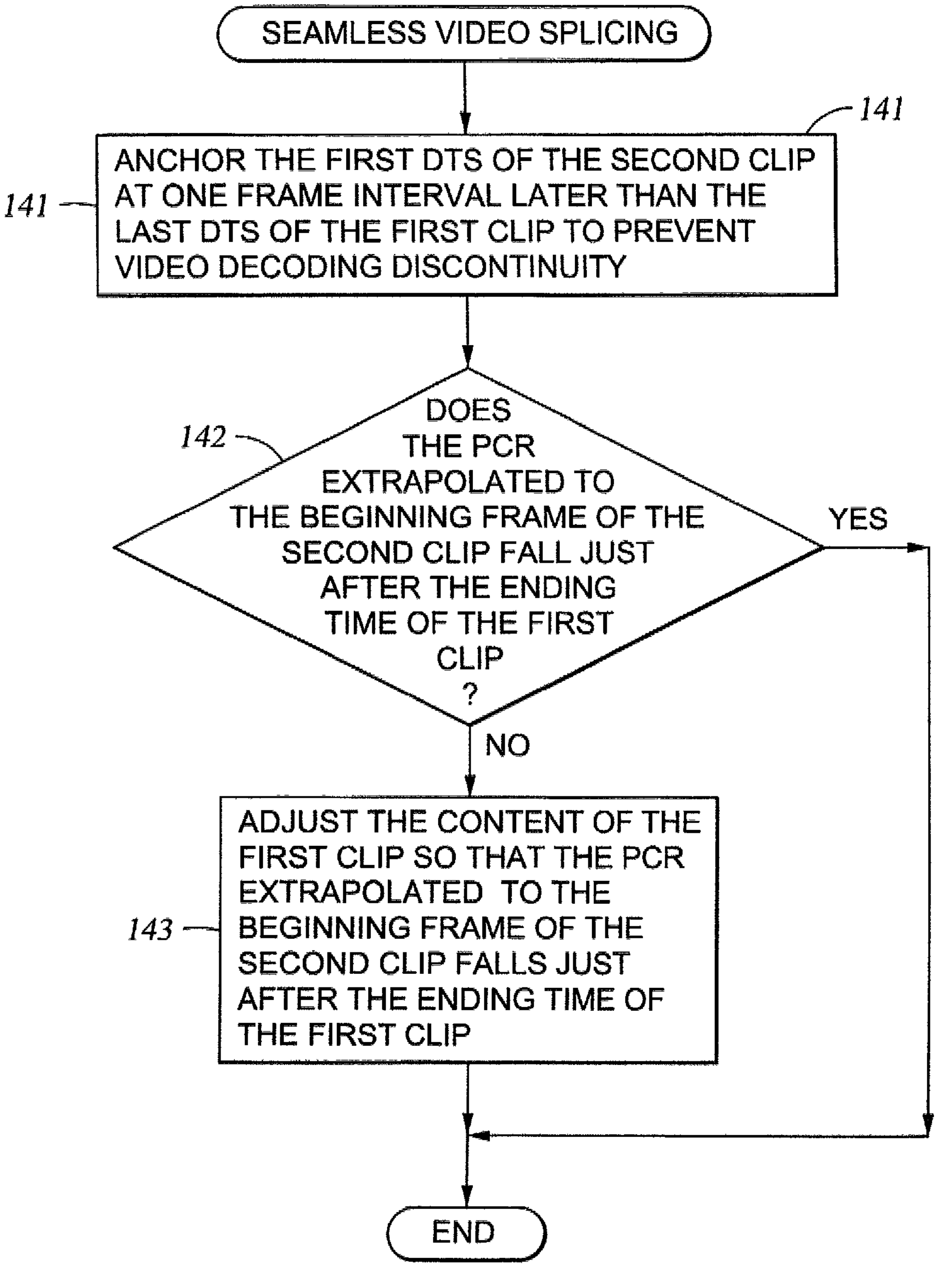

SEAMLESS VIDEO SPLICING
141
141
ANCHOR THE FIRST DTS OF THE SECOND CLIP AT ONE FRAME INTERVAL LATER THAN THE LAST DTS OF THE FIRST CLIP TO PREVENT VIDEO DECODING DISCONTINUITY
142
DOES THE PCR EXTRAPOLATED TO THE BEGINNING FRAME OF THE SECOND CLIP FALL JUST AFTER THE ENDING TIME OF THE FIRST CLIP ?
YES
NO
143
ADJUST THE CONTENT OF THE FIRST CLIP SO THAT THE PCR EXTRAPOLATED TO THE BEGINNING FRAME OF THE SECOND CLIP FALLS JUST AFTER THE ENDING TIME OF THE FIRST CLIP
END

Fig. 4

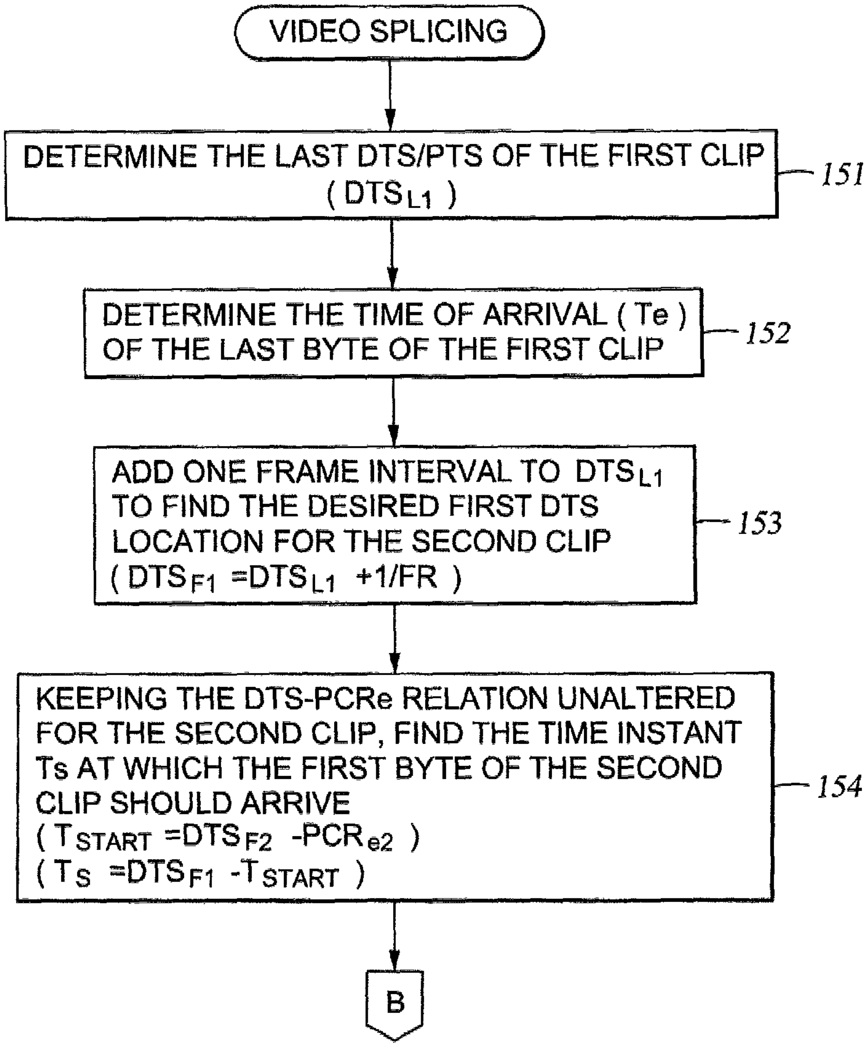

VIDEO SPLICING
DETERMINE THE LAST DTS/PTS OF THE FIRST CLIP (DTS_{L1})
151
DETERMINE THE TIME OF ARRIVAL (Te) OF THE LAST BYTE OF THE FIRST CLIP
152
ADD ONE FRAME INTERVAL TO DTS_{L1} TO FIND THE DESIRED FIRST DTS LOCATION FOR THE SECOND CLIP ($DTS_{F1} = DTS_{L1} + 1/FR$)
153
KEEPING THE DTS-PCRe RELATION UNALTERED FOR THE SECOND CLIP, FIND THE TIME INSTANT Ts AT WHICH THE FIRST BYTE OF THE SECOND CLIP SHOULD ARRIVE
($T_{START} = DTS_{F2} - PCR_{e2}$)
($T_S = DTS_{F1} - T_{START}$)
154
B

Fig. 5

Fig. 6

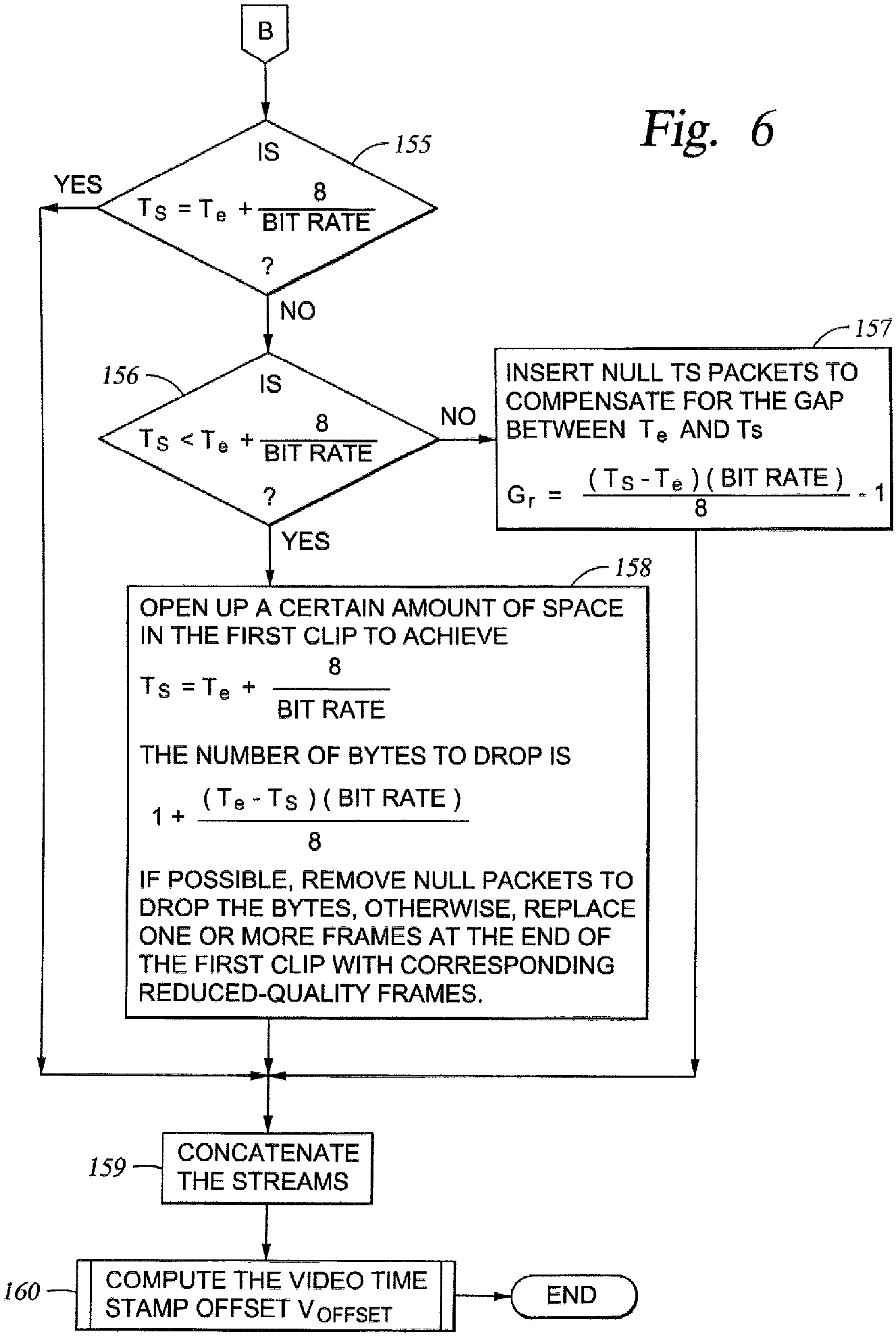

B
155
IS
$T_S = T_e + \frac{8}{\text{BIT RATE}}$
?
YES
NO
156
IS
$T_S < T_e + \frac{8}{\text{BIT RATE}}$
?
NO
YES
157
INSERT NULL TS PACKETS TO COMPENSATE FOR THE GAP BETWEEN T_e AND Ts
$G_r = \frac{(T_S - T_e)(\text{BIT RATE})}{8} - 1$
158
OPEN UP A CERTAIN AMOUNT OF SPACE IN THE FIRST CLIP TO ACHIEVE
$T_S = T_e + \frac{8}{\text{BIT RATE}}$
THE NUMBER OF BYTES TO DROP IS
$1 + \frac{(T_e - T_S)(\text{BIT RATE})}{8}$
IF POSSIBLE, REMOVE NULL PACKETS TO DROP THE BYTES, OTHERWISE, REPLACE ONE OR MORE FRAMES AT THE END OF THE FIRST CLIP WITH CORRESPONDING REDUCED-QUALITY FRAMES.
159
CONCATENATE THE STREAMS
160
COMPUTE THE VIDEO TIME STAMP OFFSET V_{OFFSET}
END

Fig. 7

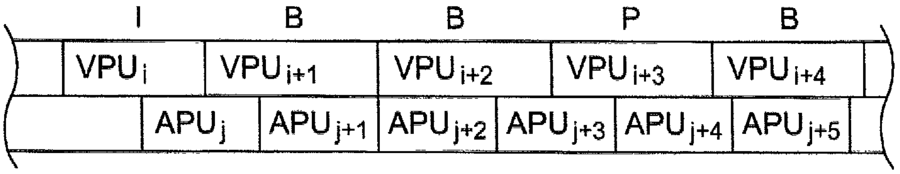
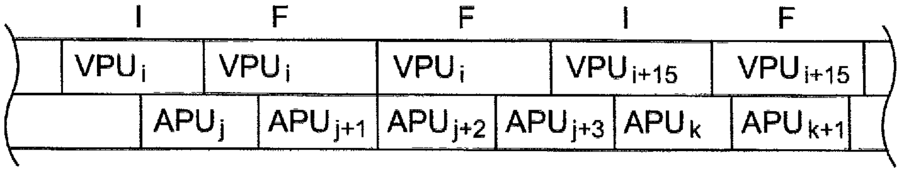


Fig. 8



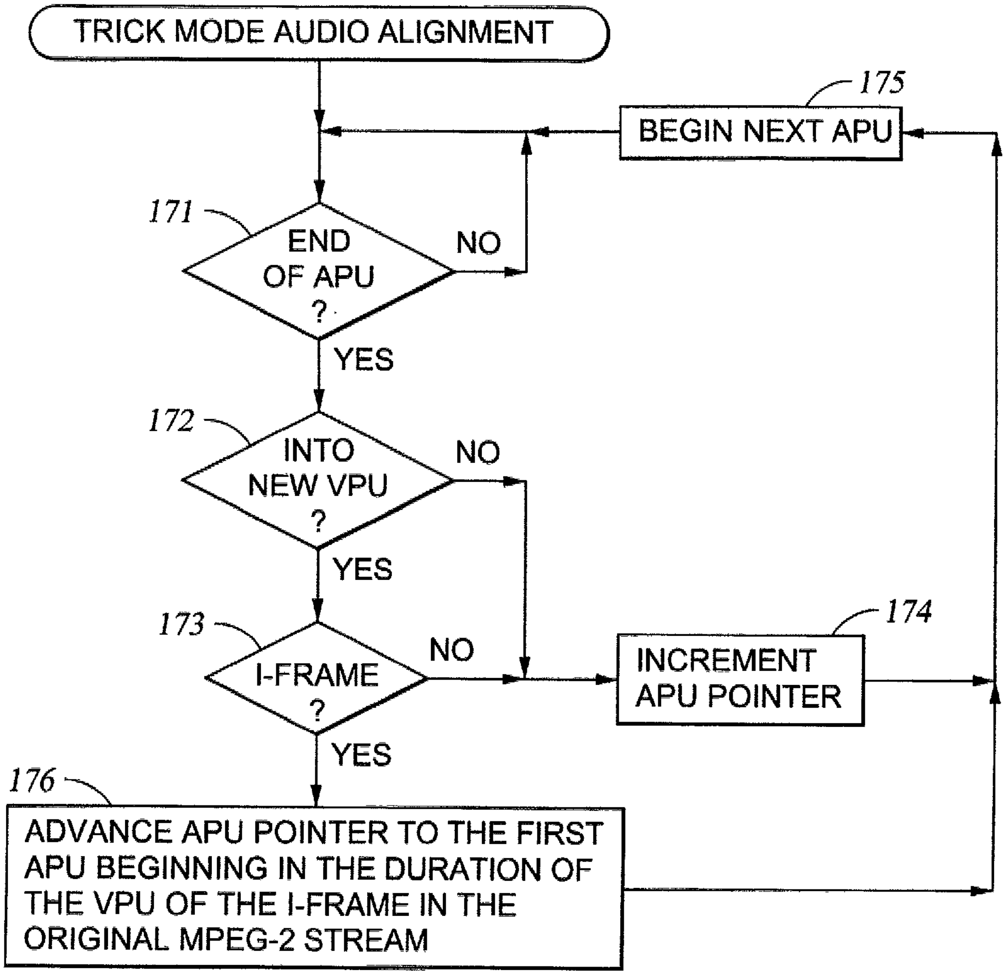


Fig. 9

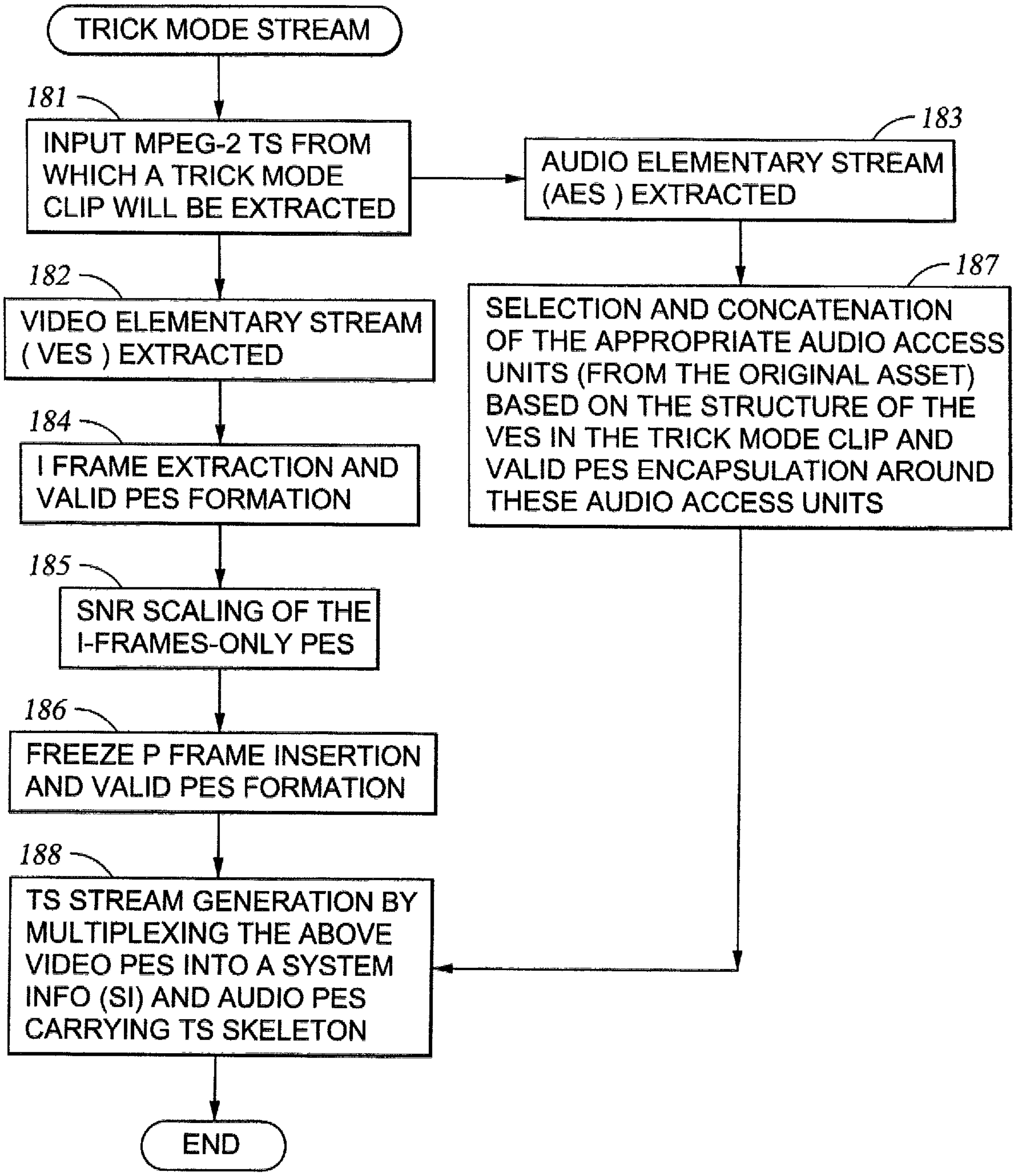

TRICK MODE STREAM
181
INPUT MPEG-2 TS FROM WHICH A TRICK MODE CLIP WILL BE EXTRACTED
183
AUDIO ELEMENTARY STREAM (AES) EXTRACTED
182
VIDEO ELEMENTARY STREAM (VES) EXTRACTED
187
SELECTION AND CONCATENATION OF THE APPROPRIATE AUDIO ACCESS UNITS (FROM THE ORIGINAL ASSET) BASED ON THE STRUCTURE OF THE VES IN THE TRICK MODE CLIP AND VALID PES ENCAPSULATION AROUND THESE AUDIO ACCESS UNITS
184
I FRAME EXTRACTION AND VALID PES FORMATION
185
SNR SCALING OF THE I-FRAMES-ONLY PES
186
FREEZE P FRAME INSERTION AND VALID PES FORMATION
188
TS STREAM GENERATION BY MULTIPLEXING THE ABOVE VIDEO PES INTO A SYSTEM INFO (SI) AND AUDIO PES CARRYING TS SKELETON
END

Fig. 10

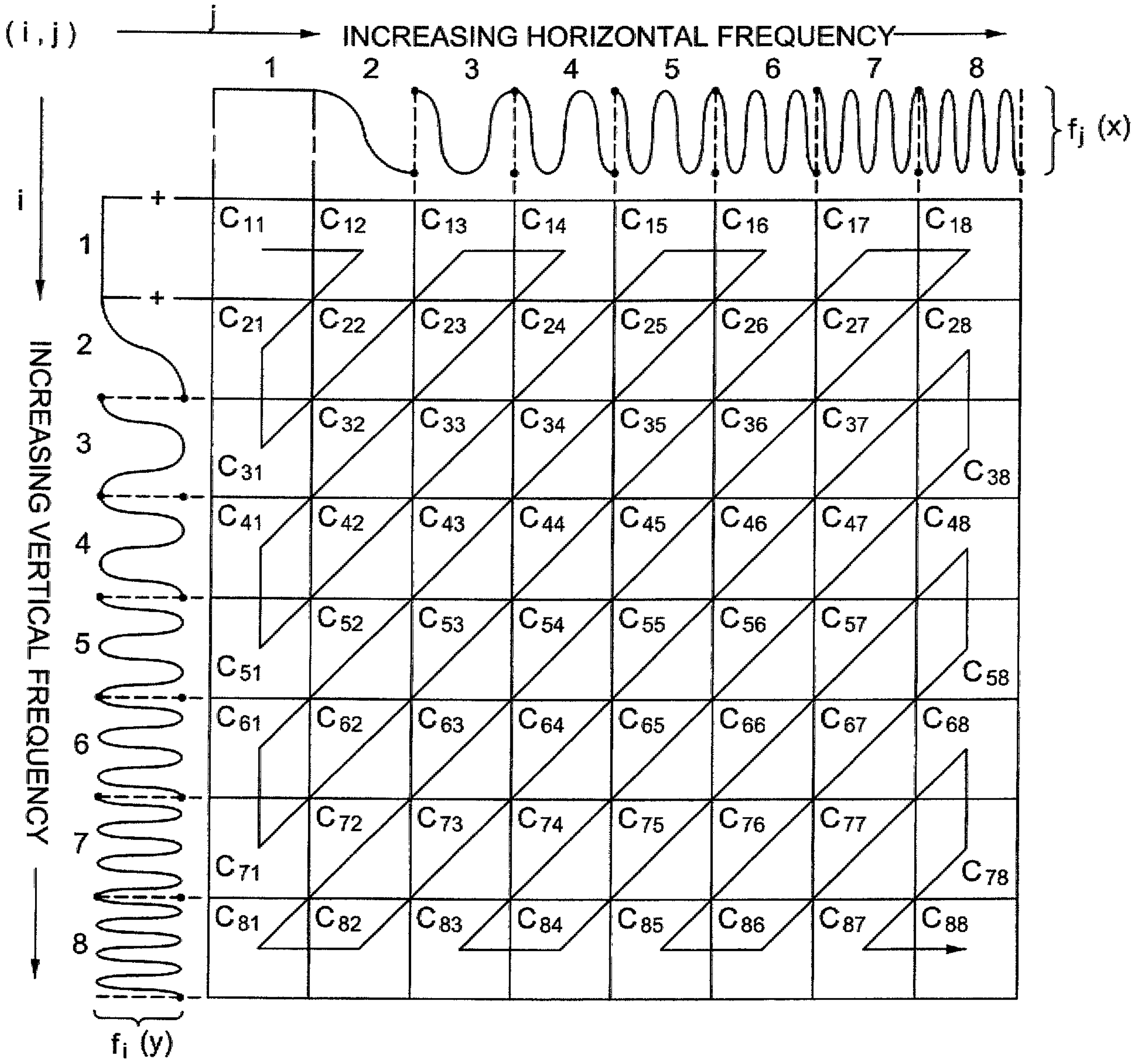


Fig. 11
(PRIOR ART)

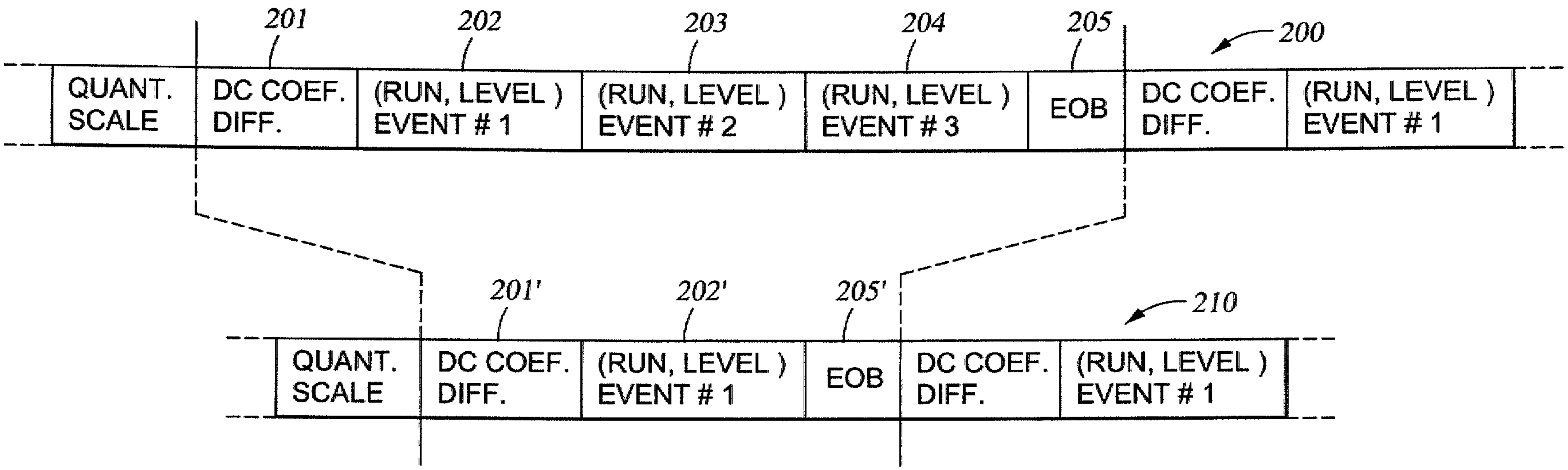

200
201
202
203
204
205
QUANT. SCALE
DC COEF. DIFF.
(RUN, LEVEL) EVENT # 1
(RUN, LEVEL) EVENT # 2
(RUN, LEVEL) EVENT # 3
EOB
DC COEF. DIFF.
(RUN, LEVEL) EVENT # 1
210
201'
202'
205'
QUANT. SCALE
DC COEF. DIFF.
(RUN, LEVEL) EVENT # 1
EOB
DC COEF. DIFF.
(RUN, LEVEL) EVENT # 1

Fig. 12

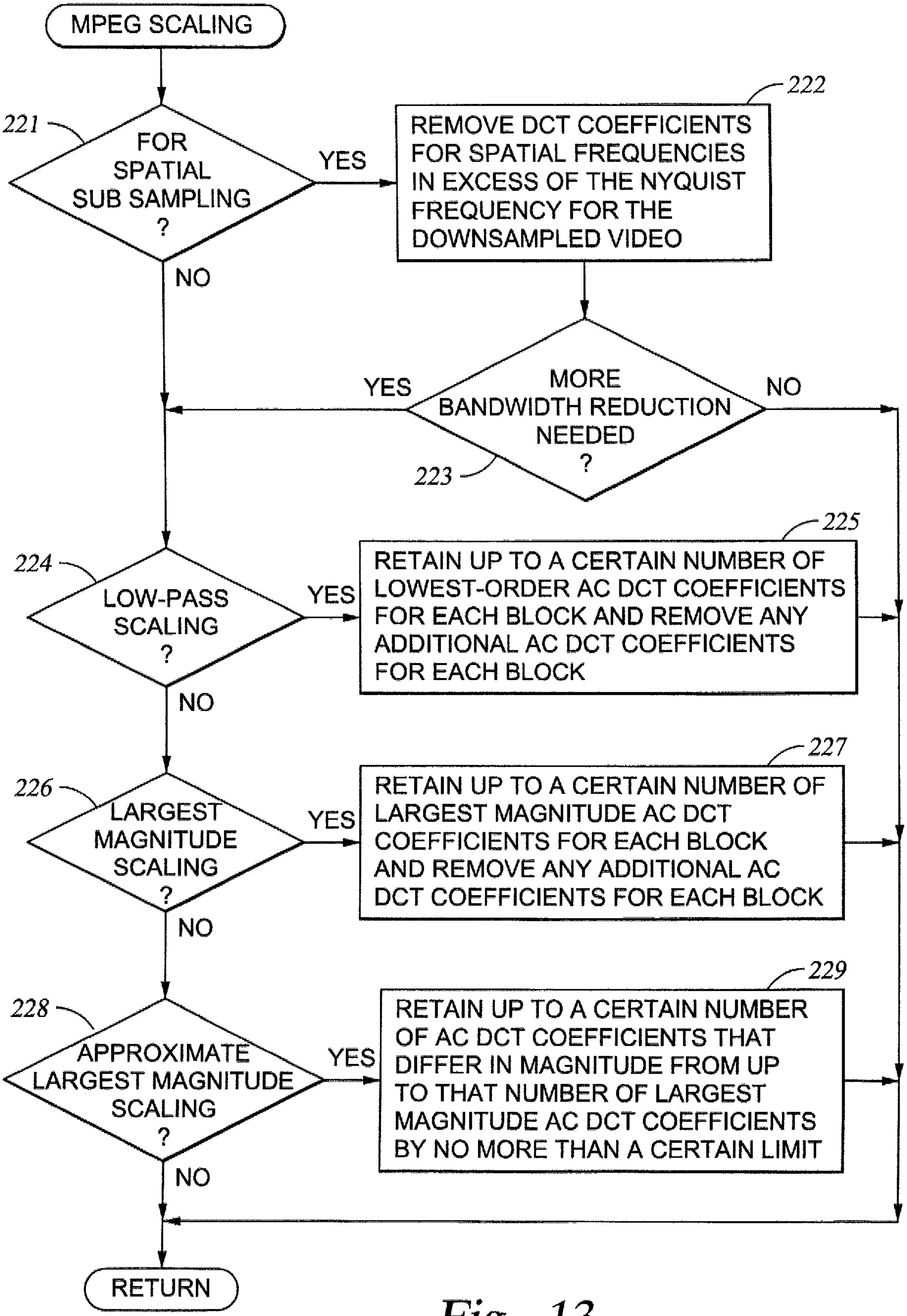

MPEG SCALING
221
FOR SPATIAL SUB SAMPLING ?
YES
NO
222
REMOVE DCT COEFFICIENTS FOR SPATIAL FREQUENCIES IN EXCESS OF THE NYQUIST FREQUENCY FOR THE DOWNSAMPLED VIDEO
MORE BANDWIDTH REDUCTION NEEDED ?
YES
NO
223
224
LOW-PASS SCALING ?
YES
NO
225
RETAIN UP TO A CERTAIN NUMBER OF LOWEST-ORDER AC DCT COEFFICIENTS FOR EACH BLOCK AND REMOVE ANY ADDITIONAL AC DCT COEFFICIENTS FOR EACH BLOCK
226
LARGEST MAGNITUDE SCALING ?
YES
NO
227
RETAIN UP TO A CERTAIN NUMBER OF LARGEST MAGNITUDE AC DCT COEFFICIENTS FOR EACH BLOCK AND REMOVE ANY ADDITIONAL AC DCT COEFFICIENTS FOR EACH BLOCK
228
APPROXIMATE LARGEST MAGNITUDE SCALING ?
YES
NO
229
RETAIN UP TO A CERTAIN NUMBER OF AC DCT COEFFICIENTS THAT DIFFER IN MAGNITUDE FROM UP TO THAT NUMBER OF LARGEST MAGNITUDE AC DCT COEFFICIENTS BY NO MORE THAN A CERTAIN LIMIT
RETURN

Fig. 13

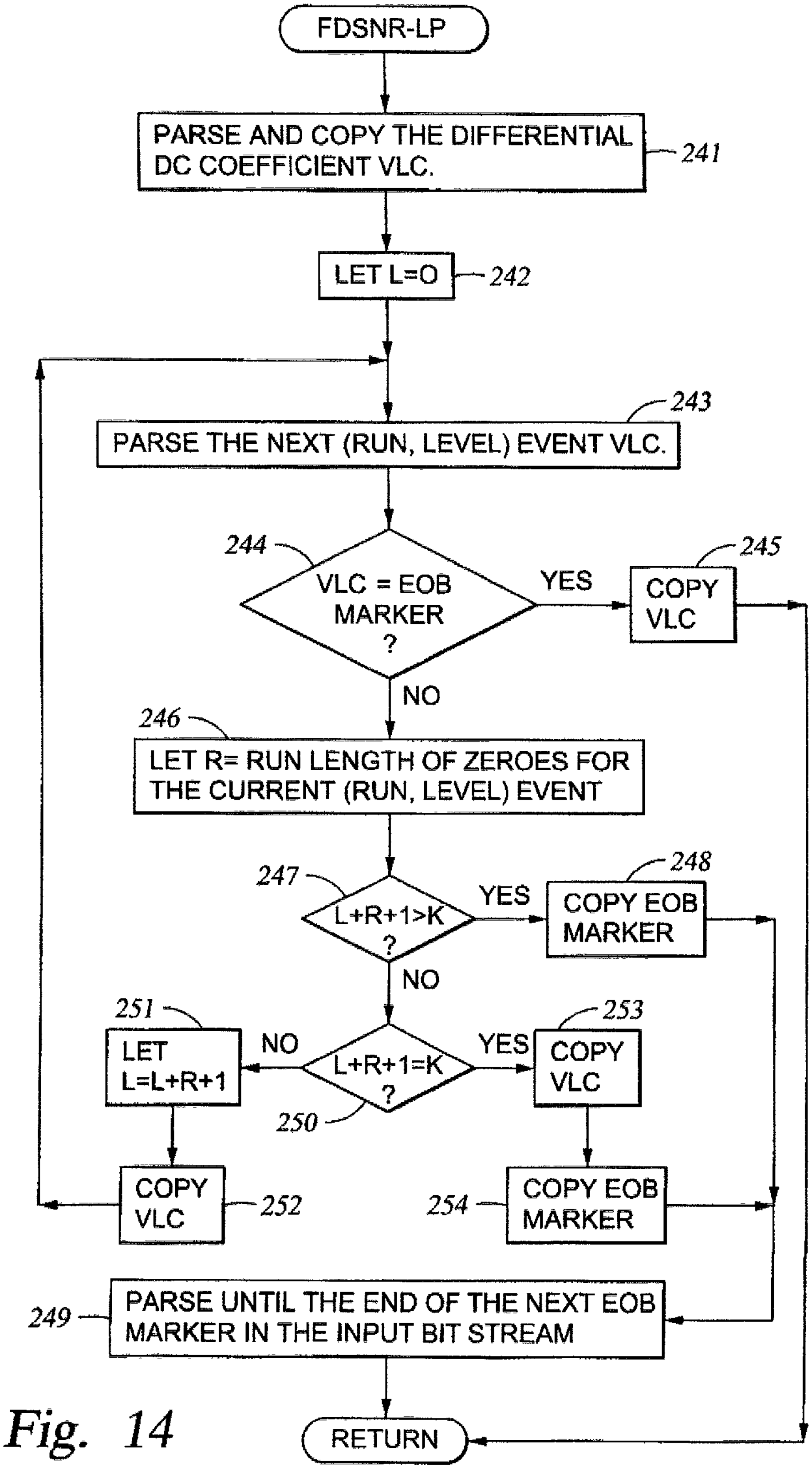

FDSNR-LP
PARSE AND COPY THE DIFFERENTIAL DC COEFFICIENT VLC.
241
LET L=O
242
243
PARSE THE NEXT (RUN, LEVEL) EVENT VLC.
244
VLC = EOB MARKER ?
YES
COPY VLC
245
NO
246
LET R= RUN LENGTH OF ZEROES FOR THE CURRENT (RUN, LEVEL) EVENT
247
L+R+1>K ?
YES
COPY EOB MARKER
248
NO
251
LET L=L+R+1
NO
L+R+1=K ?
YES
COPY VLC
253
250
COPY VLC
252
254
COPY EOB MARKER
249
PARSE UNTIL THE END OF THE NEXT EOB MARKER IN THE INPUT BIT STREAM
RETURN

Fig. 14

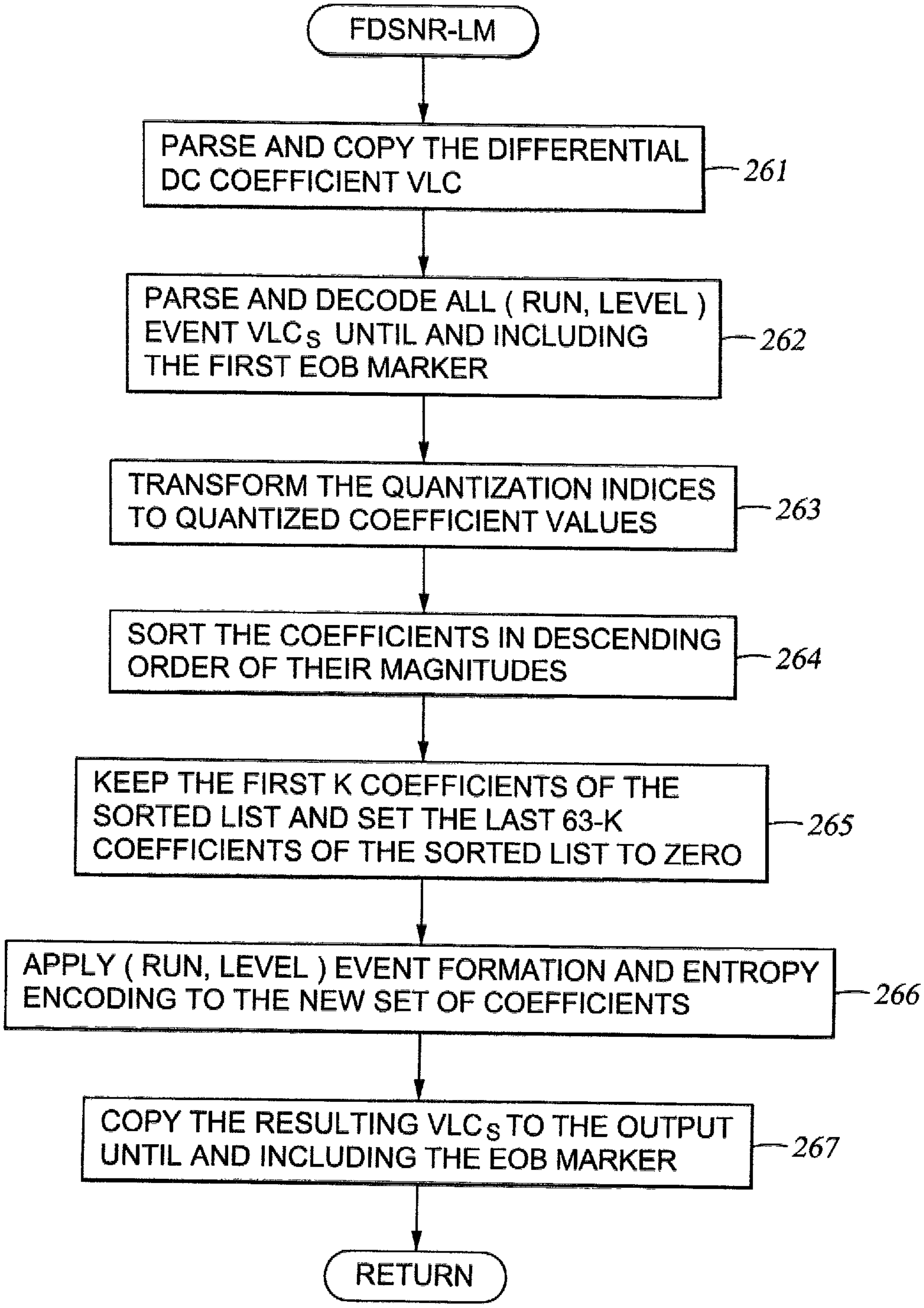

FDSNR-LM
PARSE AND COPY THE DIFFERENTIAL DC COEFFICIENT VLC
261
PARSE AND DECODE ALL (RUN, LEVEL) EVENT VLCs UNTIL AND INCLUDING THE FIRST EOB MARKER
262
TRANSFORM THE QUANTIZATION INDICES TO QUANTIZED COEFFICIENT VALUES
263
SORT THE COEFFICIENTS IN DESCENDING ORDER OF THEIR MAGNITUDES
264
KEEP THE FIRST K COEFFICIENTS OF THE SORTED LIST AND SET THE LAST 63-K COEFFICIENTS OF THE SORTED LIST TO ZERO
265
APPLY (RUN, LEVEL) EVENT FORMATION AND ENTROPY ENCODING TO THE NEW SET OF COEFFICIENTS
266
COPY THE RESULTING VLCs TO THE OUTPUT UNTIL AND INCLUDING THE EOB MARKER
267
RETURN

Fig. 15

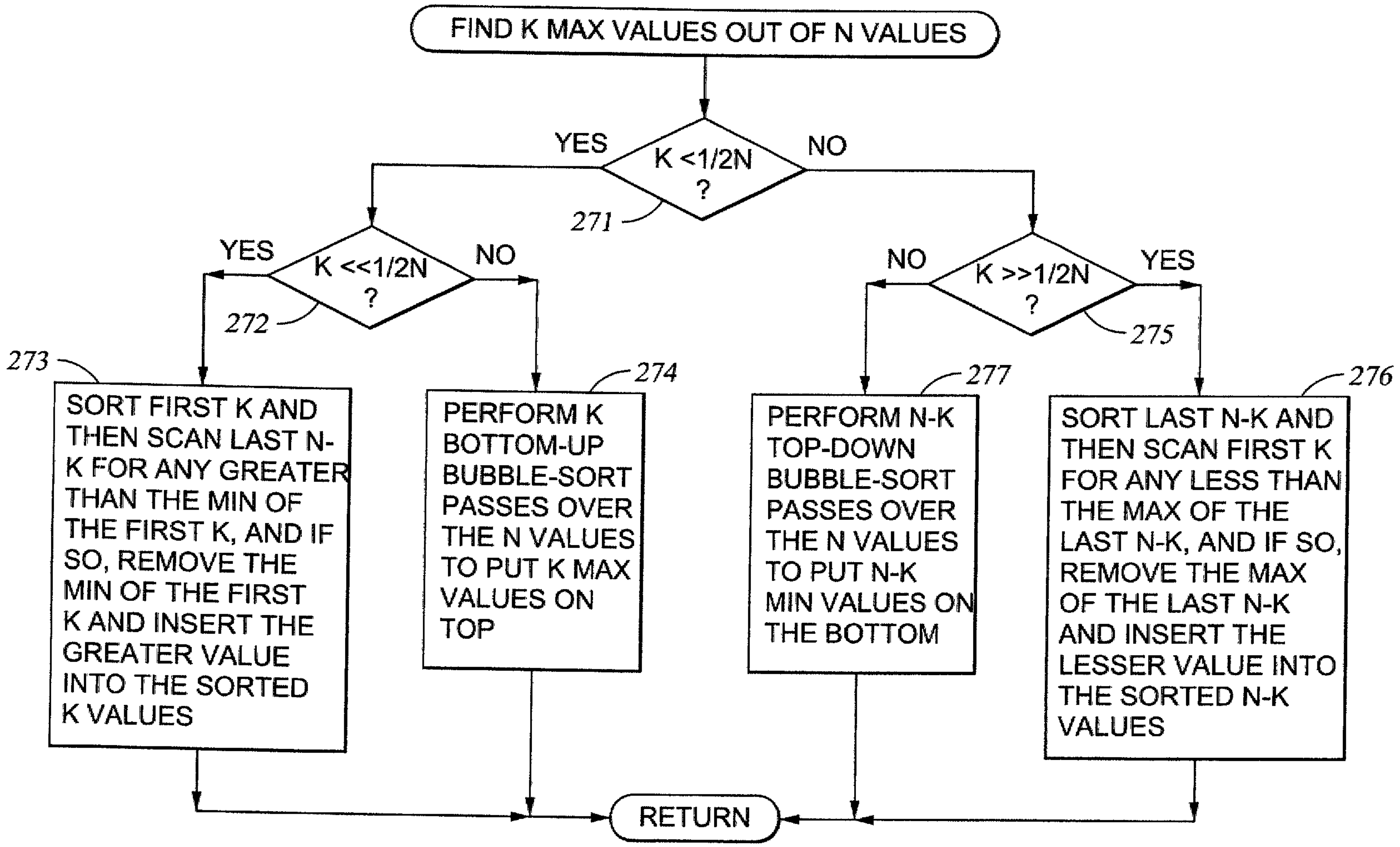
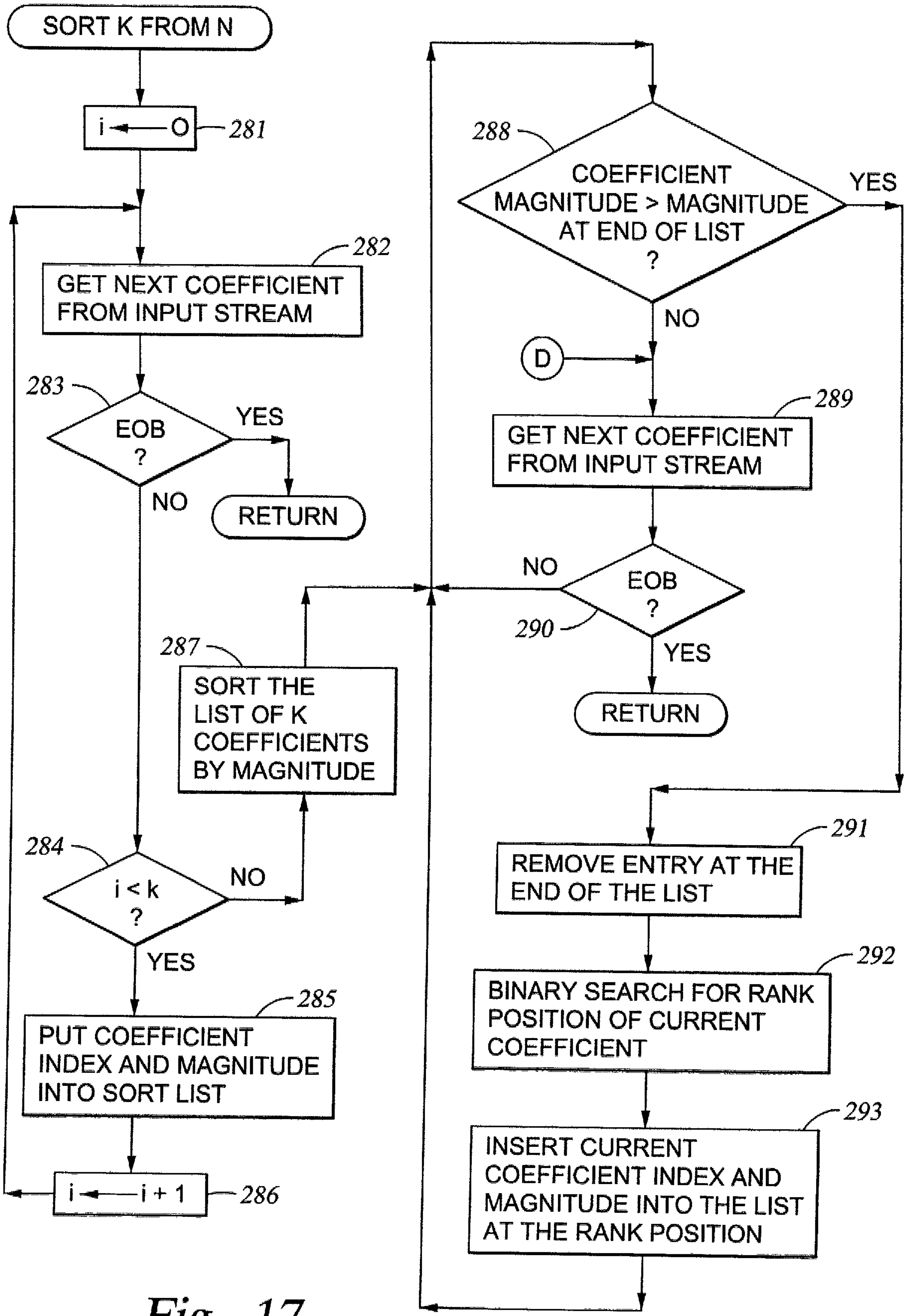

FIND K MAX VALUES OUT OF N VALUES
K <1/2N ?
271
YES
NO
K <<1/2N ?
272
YES
NO
K >>1/2N ?
275
NO
YES
273
SORT FIRST K AND THEN SCAN LAST N-K FOR ANY GREATER THAN THE MIN OF THE FIRST K, AND IF SO, REMOVE THE MIN OF THE FIRST K AND INSERT THE GREATER VALUE INTO THE SORTED K VALUES
274
PERFORM K BOTTOM-UP BUBBLE-SORT PASSES OVER THE N VALUES TO PUT K MAX VALUES ON TOP
277
PERFORM N-K TOP-DOWN BUBBLE-SORT PASSES OVER THE N VALUES TO PUT N-K MIN VALUES ON THE BOTTOM
276
SORT LAST N-K AND THEN SCAN FIRST K FOR ANY LESS THAN THE MAX OF THE LAST N-K, AND IF SO, REMOVE THE MAX OF THE LAST N-K AND INSERT THE LESSER VALUE INTO THE SORTED N-K VALUES
RETURN

Fig. 16



SORT K FROM N
i ← O
281
282
GET NEXT COEFFICIENT FROM INPUT STREAM
283
EOB ?
YES
RETURN
NO
287
SORT THE LIST OF K COEFFICIENTS BY MAGNITUDE
284
i < k ?
NO
YES
285
PUT COEFFICIENT INDEX AND MAGNITUDE INTO SORT LIST
i ← i + 1
286
288
COEFFICIENT MAGNITUDE > MAGNITUDE AT END OF LIST ?
YES
NO
D
289
GET NEXT COEFFICIENT FROM INPUT STREAM
NO
EOB ?
290
YES
RETURN
291
REMOVE ENTRY AT THE END OF THE LIST
292
BINARY SEARCH FOR RANK POSITION OF CURRENT COEFFICIENT
293
INSERT CURRENT COEFFICIENT INDEX AND MAGNITUDE INTO THE LIST AT THE RANK POSITION

Fig. 17

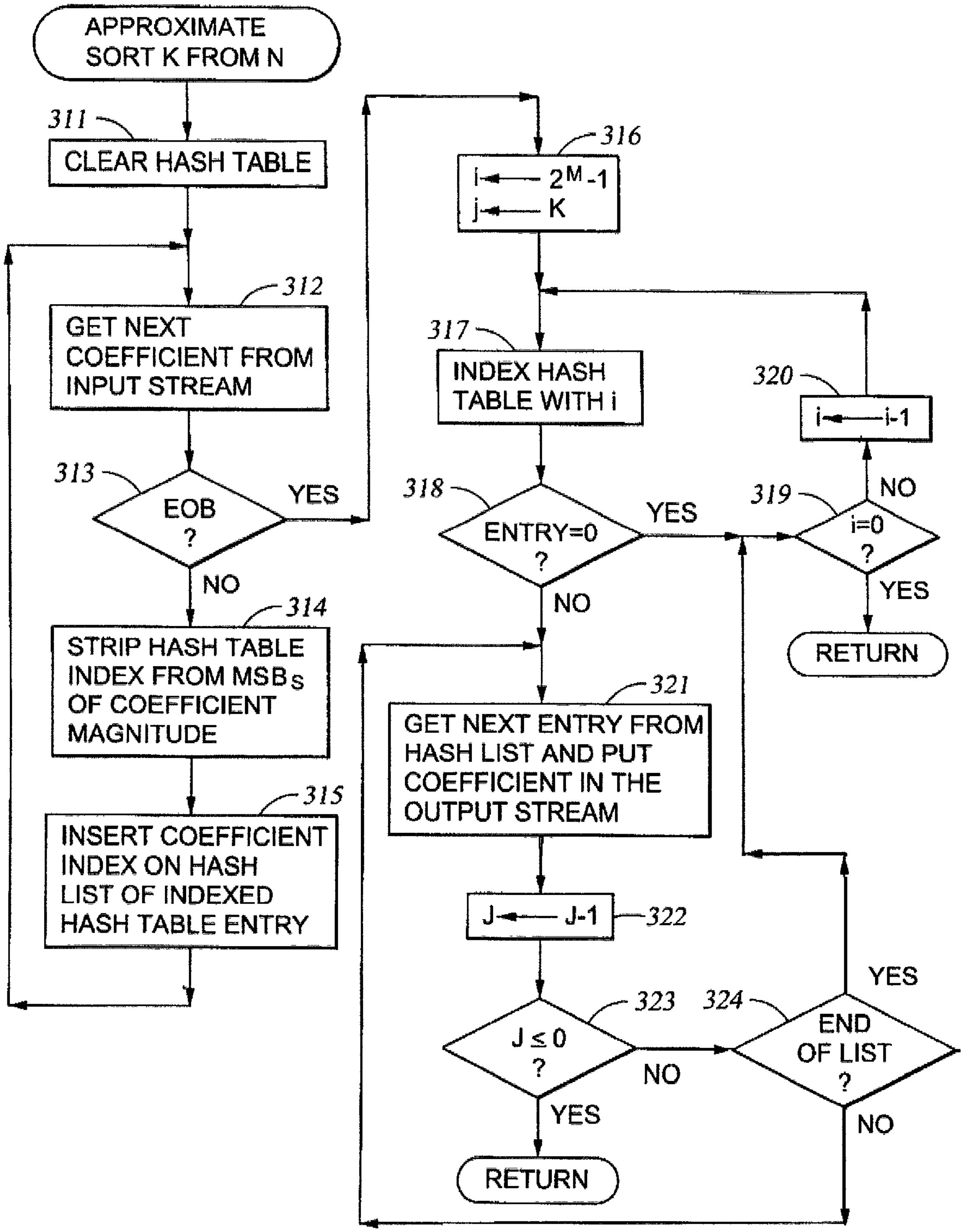

APPROXIMATE SORT K FROM N
311
CLEAR HASH TABLE
312
GET NEXT COEFFICIENT FROM INPUT STREAM
313
EOB ?
YES
NO
314
STRIP HASH TABLE INDEX FROM MSBs OF COEFFICIENT MAGNITUDE
315
INSERT COEFFICIENT INDEX ON HASH LIST OF INDEXED HASH TABLE ENTRY
316
i ← 2^M-1
j ← K
317
INDEX HASH TABLE WITH i
318
ENTRY=0 ?
YES
NO
319
i=0 ?
NO
YES
320
i ← i-1
RETURN
321
GET NEXT ENTRY FROM HASH LIST AND PUT COEFFICIENT IN THE OUTPUT STREAM
J ← J-1
322
323
J ≤ 0 ?
YES
NO
RETURN
324
END OF LIST ?
YES
NO

Fig. 19

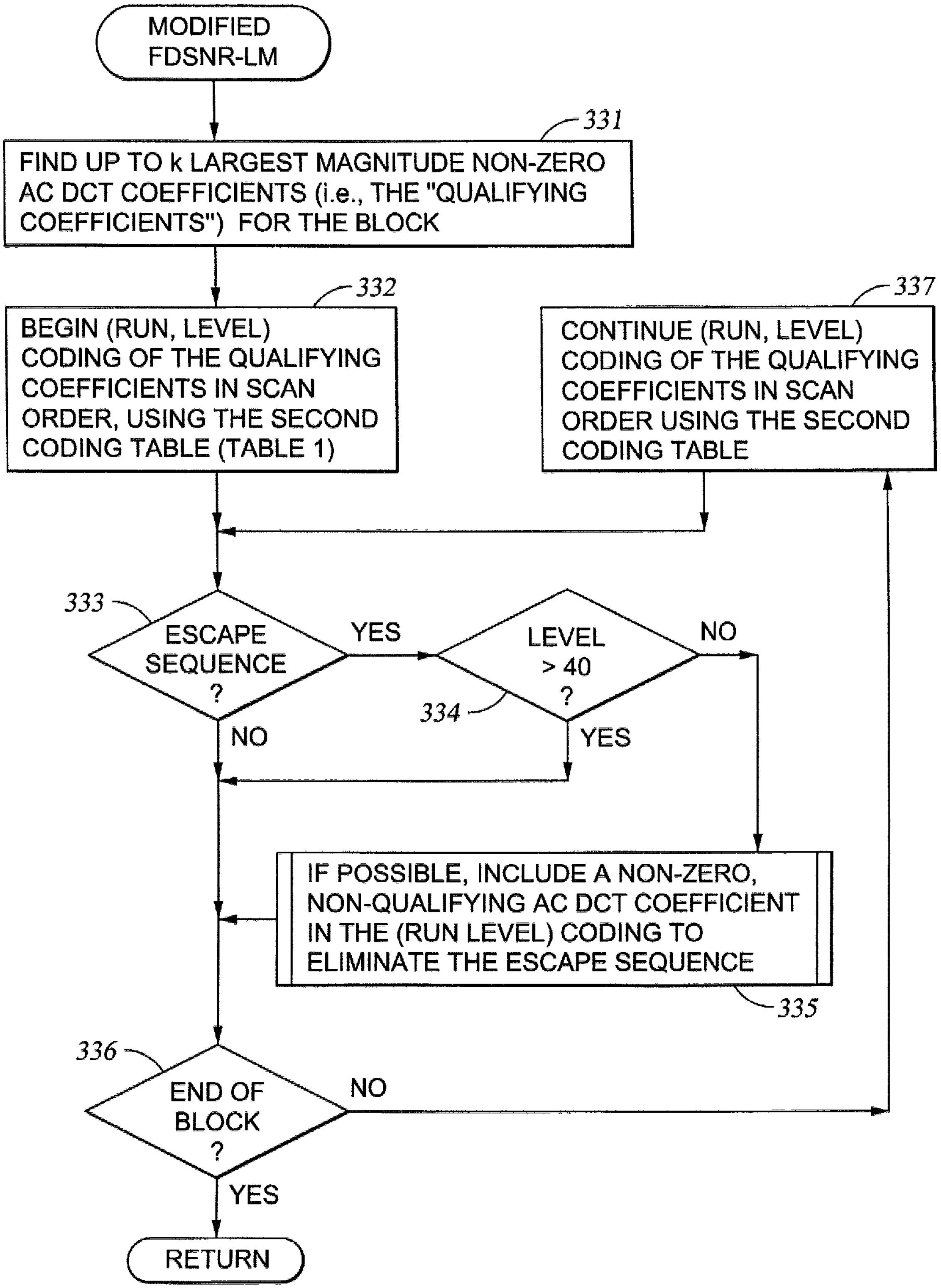
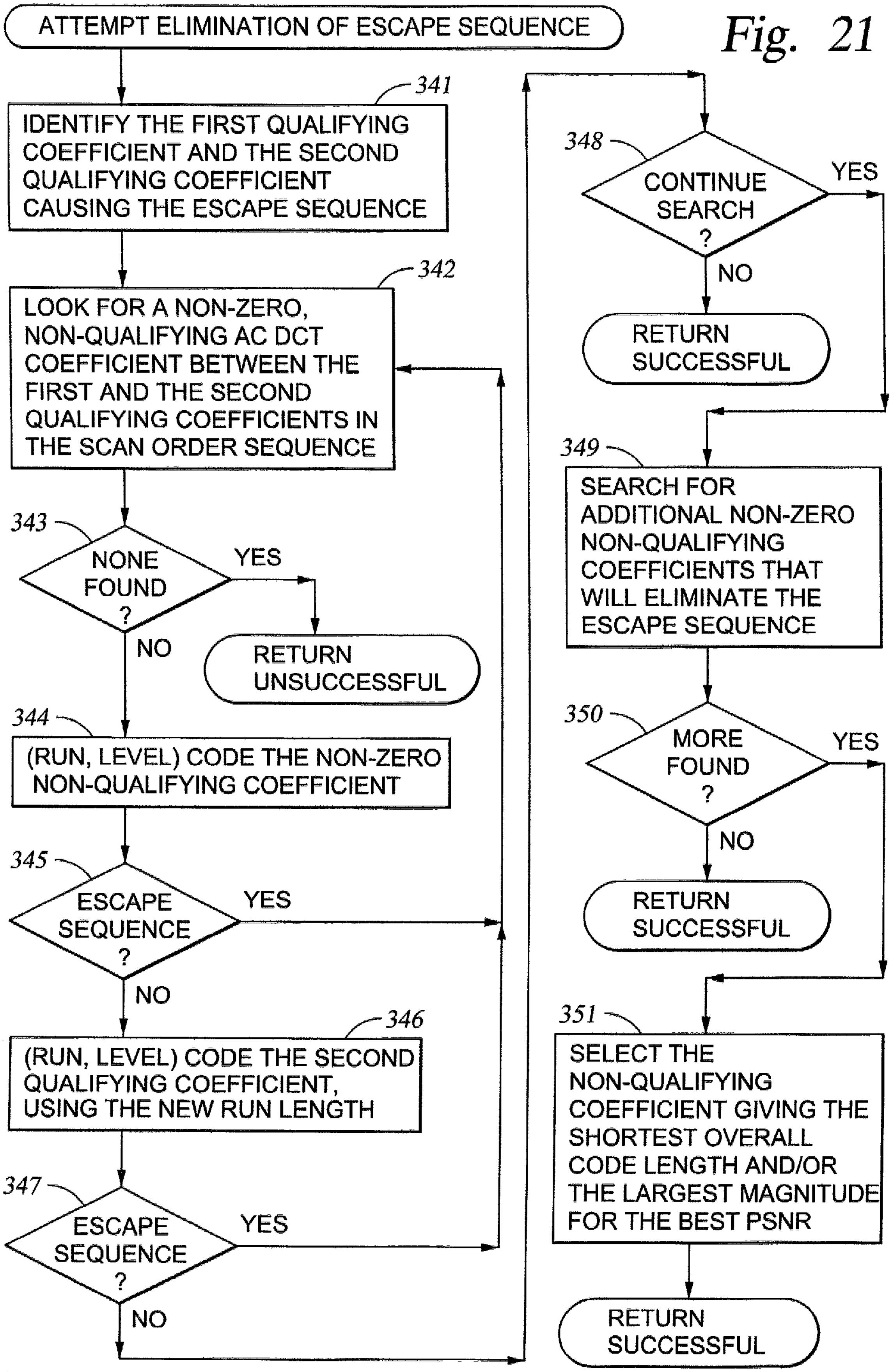

MODIFIED FDSNR-LM
331
FIND UP TO k LARGEST MAGNITUDE NON-ZERO AC DCT COEFFICIENTS (i.e., THE "QUALIFYING COEFFICIENTS") FOR THE BLOCK
332
BEGIN (RUN, LEVEL) CODING OF THE QUALIFYING COEFFICIENTS IN SCAN ORDER, USING THE SECOND CODING TABLE (TABLE 1)
337
CONTINUE (RUN, LEVEL) CODING OF THE QUALIFYING COEFFICIENTS IN SCAN ORDER USING THE SECOND CODING TABLE
333
ESCAPE SEQUENCE ?
YES
334
LEVEL > 40 ?
NO
NO
YES
IF POSSIBLE, INCLUDE A NON-ZERO, NON-QUALIFYING AC DCT COEFFICIENT IN THE (RUN LEVEL) CODING TO ELIMINATE THE ESCAPE SEQUENCE
335
336
END OF BLOCK ?
NO
YES
RETURN

Fig. 20

Fig. 21


ATTEMPT ELIMINATION OF ESCAPE SEQUENCE
341
IDENTIFY THE FIRST QUALIFYING COEFFICIENT AND THE SECOND QUALIFYING COEFFICIENT CAUSING THE ESCAPE SEQUENCE
342
LOOK FOR A NON-ZERO, NON-QUALIFYING AC DCT COEFFICIENT BETWEEN THE FIRST AND THE SECOND QUALIFYING COEFFICIENTS IN THE SCAN ORDER SEQUENCE
343
NONE FOUND ?
YES
RETURN UNSUCCESSFUL
NO
344
(RUN, LEVEL) CODE THE NON-ZERO NON-QUALIFYING COEFFICIENT
345
ESCAPE SEQUENCE ?
YES
NO
346
(RUN, LEVEL) CODE THE SECOND QUALIFYING COEFFICIENT, USING THE NEW RUN LENGTH
347
ESCAPE SEQUENCE ?
YES
NO
348
CONTINUE SEARCH ?
YES
NO
RETURN SUCCESSFUL
349
SEARCH FOR ADDITIONAL NON-ZERO NON-QUALIFYING COEFFICIENTS THAT WILL ELIMINATE THE ESCAPE SEQUENCE
350
MORE FOUND ?
YES
NO
RETURN SUCCESSFUL
351
SELECT THE NON-QUALIFYING COEFFICIENT GIVING THE SHORTEST OVERALL CODE LENGTH AND/OR THE LARGEST MAGNITUDE FOR THE BEST PSNR
RETURN SUCCESSFUL

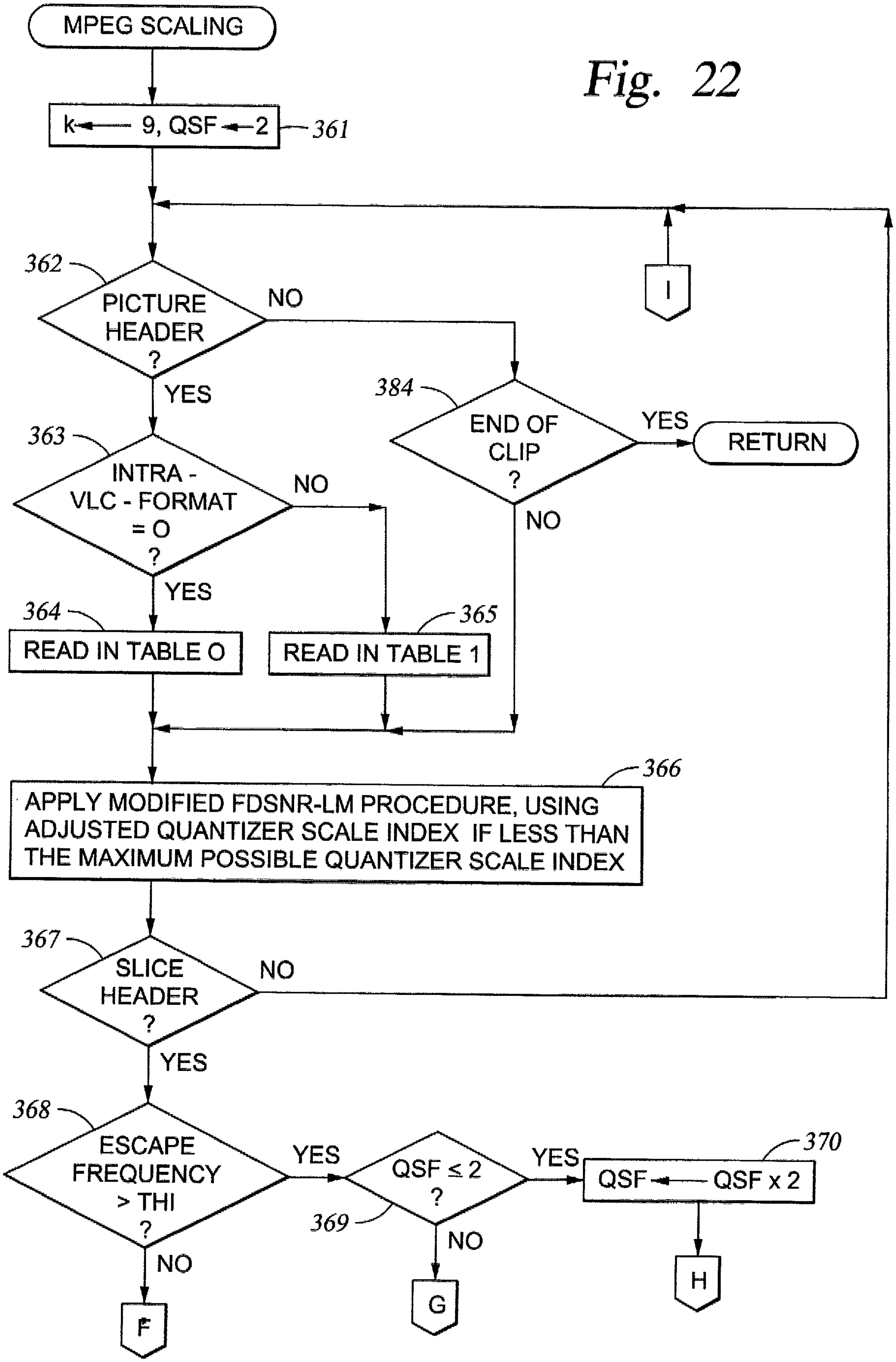
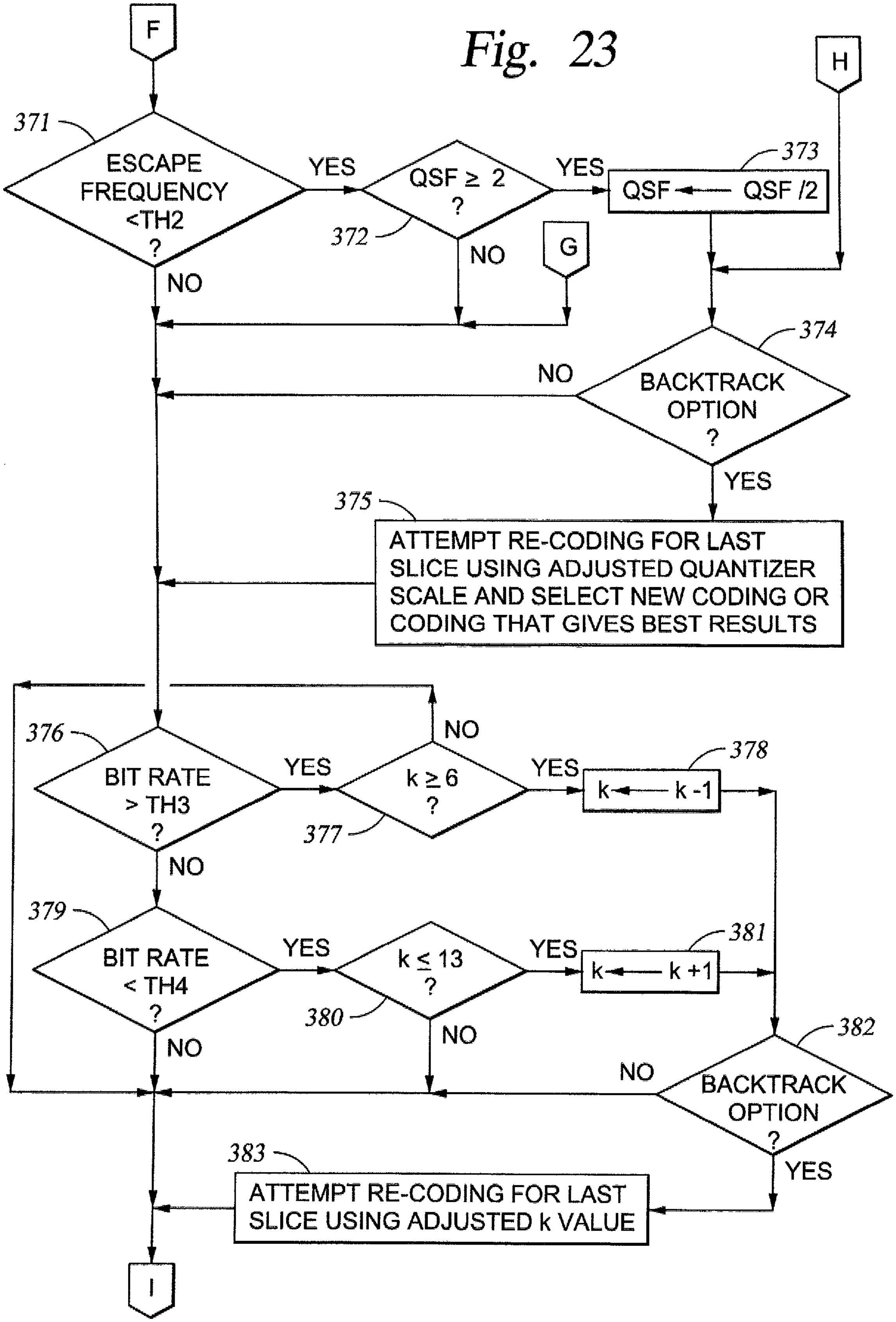

MPEG SCALING
k ← 9, QSF ← 2
361
362
PICTURE HEADER ?
NO
YES
I
384
END OF CLIP ?
YES
RETURN
NO
363
INTRA - VLC - FORMAT = O ?
NO
YES
364
READ IN TABLE O
365
READ IN TABLE 1
366
APPLY MODIFIED FDSNR-LM PROCEDURE, USING ADJUSTED QUANTIZER SCALE INDEX IF LESS THAN THE MAXIMUM POSSIBLE QUANTIZER SCALE INDEX
367
SLICE HEADER ?
NO
YES
368
ESCAPE FREQUENCY > THI ?
YES
369
QSF ≤ 2 ?
YES
370
QSF ← QSF x 2
NO
NO
F
G
H

Fig. 22

Fig. 23


F
H
371
ESCAPE FREQUENCY <TH2 ?
YES
NO
372
QSF ≥ 2 ?
YES
NO
G
373
QSF ← QSF /2
374
BACKTRACK OPTION ?
NO
YES
375
ATTEMPT RE-CODING FOR LAST SLICE USING ADJUSTED QUANTIZER SCALE AND SELECT NEW CODING OR CODING THAT GIVES BEST RESULTS
376
BIT RATE > TH3 ?
YES
NO
377
k ≥ 6 ?
YES
NO
378
k ← k -1
379
BIT RATE < TH4 ?
YES
NO
380
k ≤ 13 ?
YES
NO
381
k ← k +1
382
BACKTRACK OPTION ?
NO
YES
383
ATTEMPT RE-CODING FOR LAST SLICE USING ADJUSTED k VALUE
I

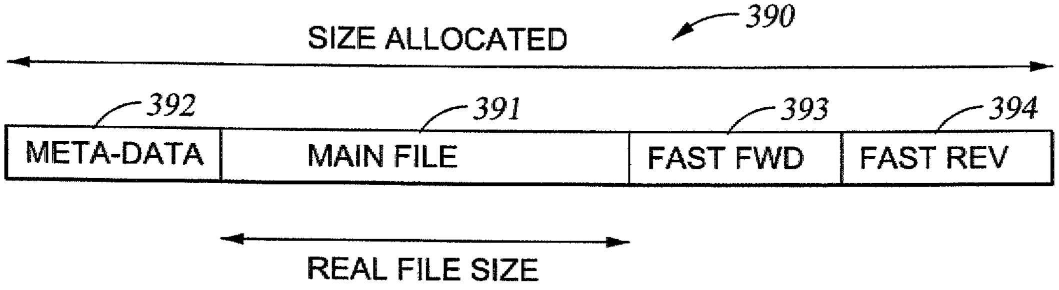

390
SIZE ALLOCATED
392
391
393
394
META-DATA
MAIN FILE
FAST FWD
FAST REV
REAL FILE SIZE

Fig. 24

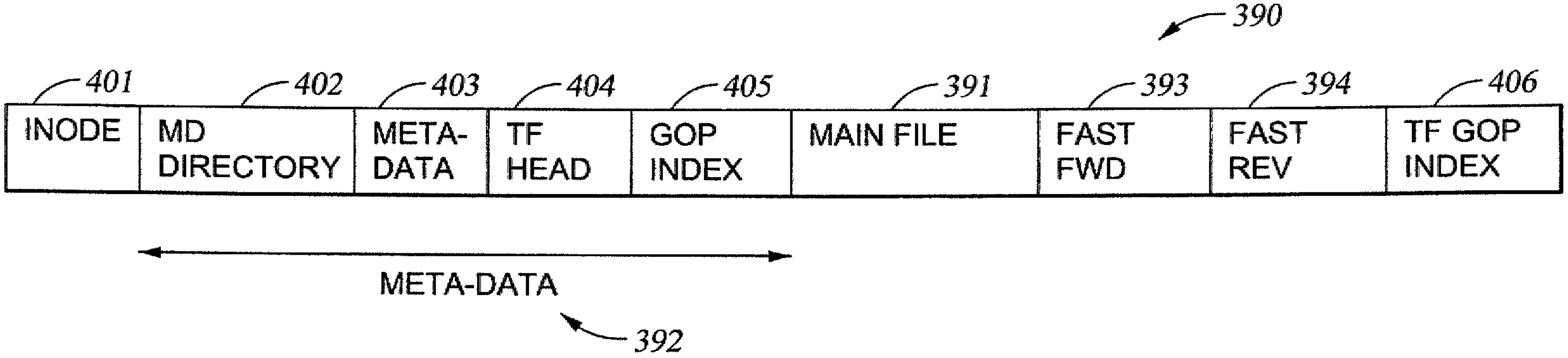

390
401
402
403
404
405
391
393
394
406
INODE
MD DIRECTORY
META-DATA
TF HEAD
GOP INDEX
MAIN FILE
FAST FWD
FAST REV
TF GOP INDEX
META-DATA
392

Fig. 25

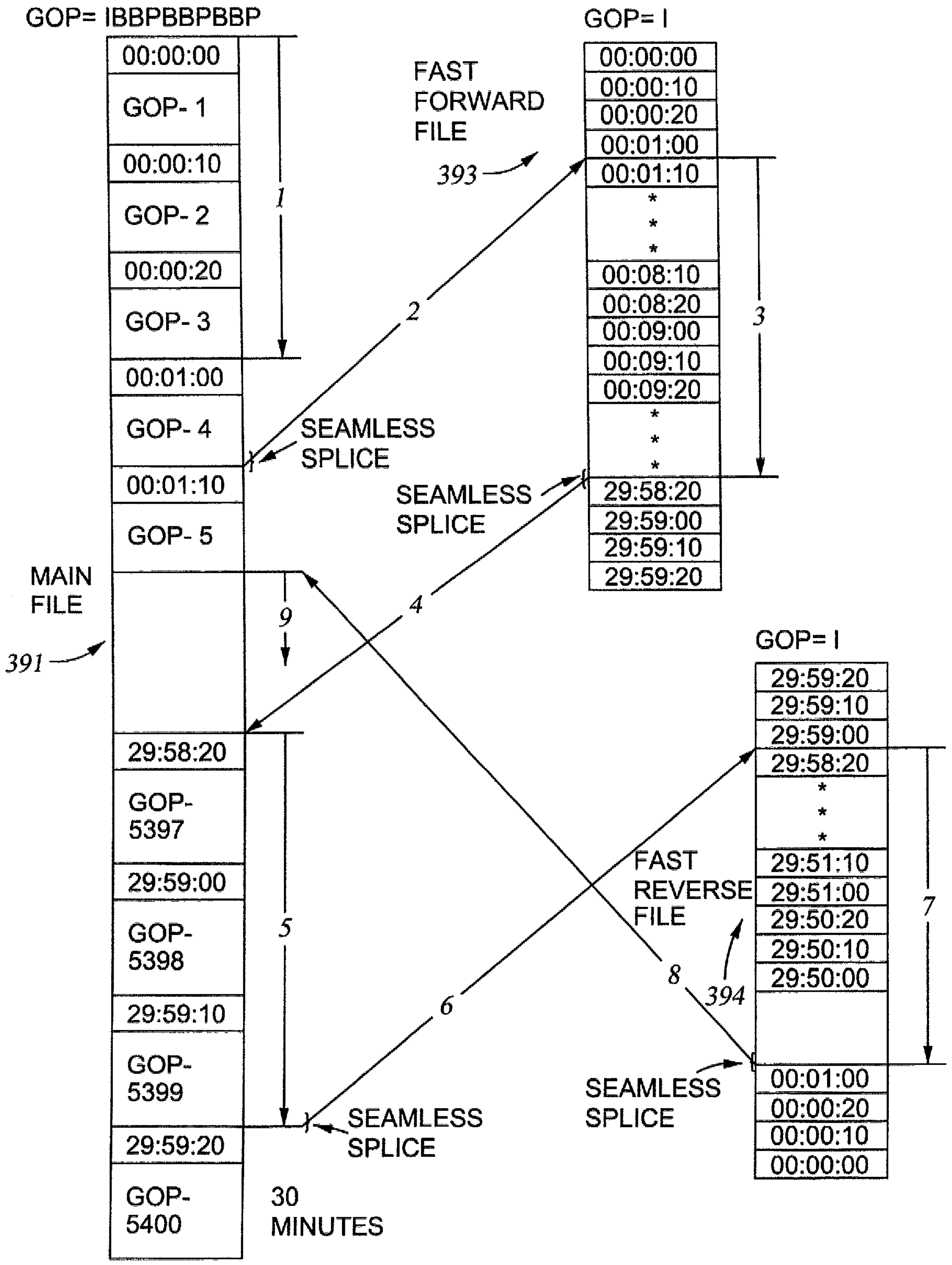

GOP= IBBPBBPBBP
00:00:00
GOP- 1
00:00:10
GOP- 2
00:00:20
GOP- 3
00:01:00
GOP- 4
00:01:10
GOP- 5
29:58:20
GOP- 5397
29:59:00
GOP- 5398
29:59:10
GOP- 5399
29:59:20
GOP- 5400
30 MINUTES
MAIN FILE
391
1
2
3
4
5
6
7
8
9
SEAMLESS SPLICE
SEAMLESS SPLICE
SEAMLESS SPLICE
SEAMLESS SPLICE
GOP= I
FAST FORWARD FILE
393
00:00:00
00:00:10
00:00:20
00:01:00
00:01:10
* * *
00:08:10
00:08:20
00:09:00
00:09:10
00:09:20
* * *
29:58:20
29:59:00
29:59:10
29:59:20
GOP= I
FAST REVERSE FILE
394
29:59:20
29:59:10
29:59:00
29:58:20
* * *
29:51:10
29:51:00
29:50:20
29:50:10
29:50:00
00:01:00
00:00:20
00:00:10
00:00:00

Fig. 26A

Fig. 26B

1- Play from start 1 sec
2- Pause
3- Fast Forward to 29 min
4- Pause
5- Play 1 sec
6- Pause
7- Fast Reverse to 1 sec
8- Pause
9- Play Normal

	READ	WRITE
COPY OF THE ASSET WITH ALL THE DATA	EMPEG2	EMPEG2
COPY ONLY THE MAIN ASSET	RAW	MPEG2
ARCHIVE	EMPEG2	EMPEG2
PLAY	MPEG2	
RECORD		MPEG2

Fig. 27

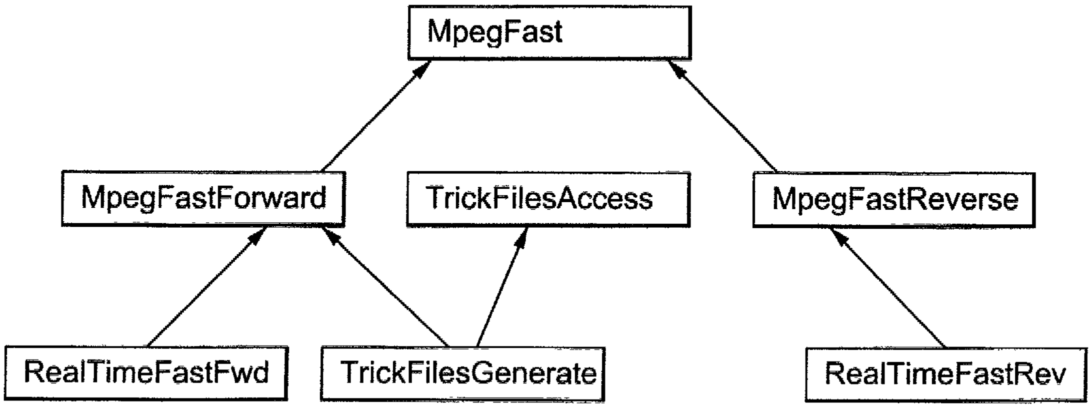


Fig. 28

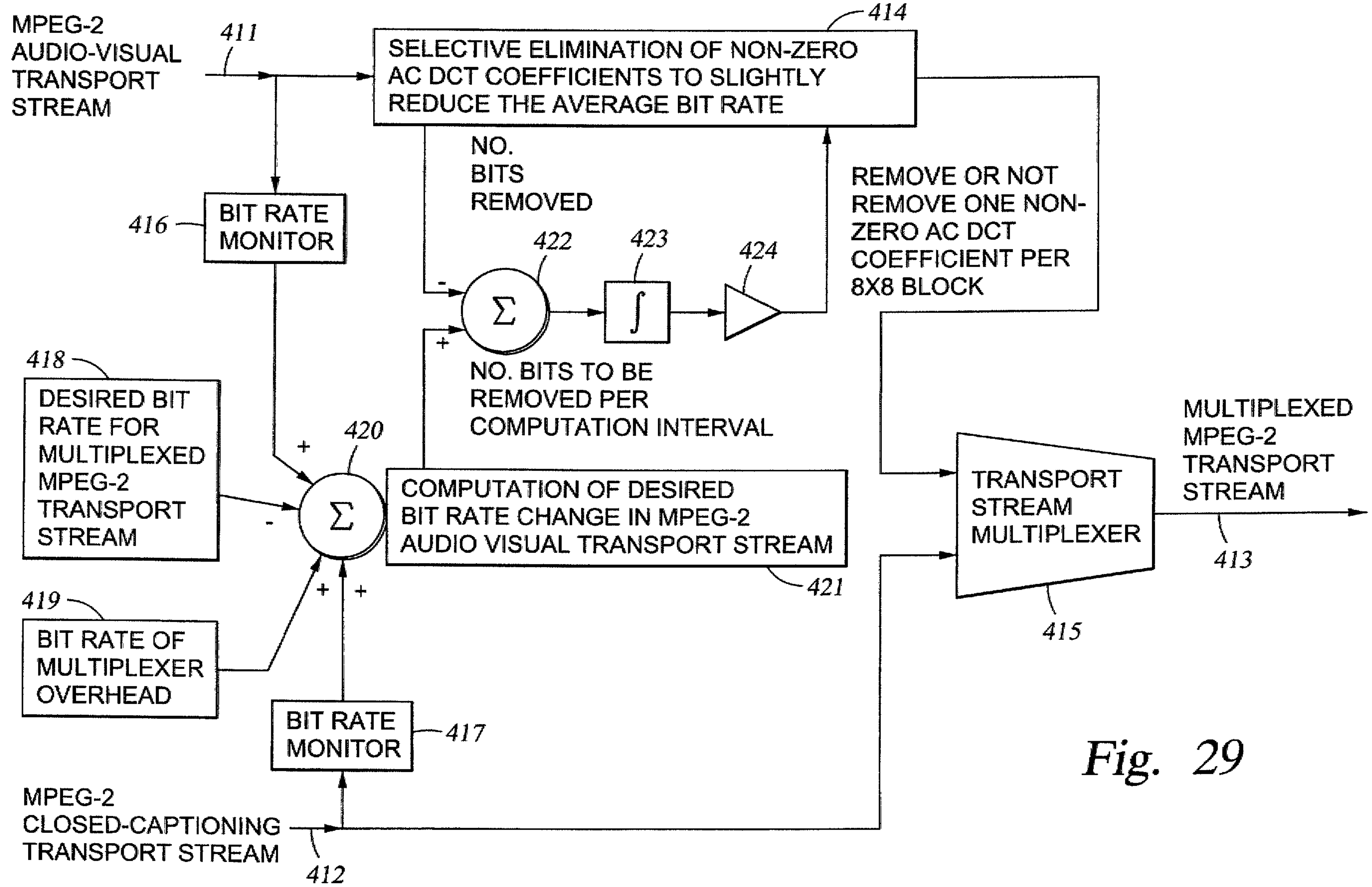

MPEG-2
AUDIO-VISUAL
TRANSPORT
STREAM
411
414
SELECTIVE ELIMINATION OF NON-ZERO AC DCT COEFFICIENTS TO SLIGHTLY REDUCE THE AVERAGE BIT RATE
NO. BITS REMOVED
REMOVE OR NOT REMOVE ONE NON-ZERO AC DCT COEFFICIENT PER 8X8 BLOCK
416
BIT RATE MONITOR
422
423
424
-
+
Σ
∫
NO. BITS TO BE REMOVED PER COMPUTATION INTERVAL
418
DESIRED BIT RATE FOR MULTIPLEXED MPEG-2 TRANSPORT STREAM
420
+
-
+
+
Σ
COMPUTATION OF DESIRED BIT RATE CHANGE IN MPEG-2 AUDIO VISUAL TRANSPORT STREAM
421
419
BIT RATE OF MULTIPLEXER OVERHEAD
BIT RATE MONITOR
417
MPEG-2
CLOSED-CAPTIONING
TRANSPORT STREAM
412
TRANSPORT STREAM MULTIPLEXER
415
MULTIPLEXED
MPEG-2
TRANSPORT
STREAM
413

Fig. 29

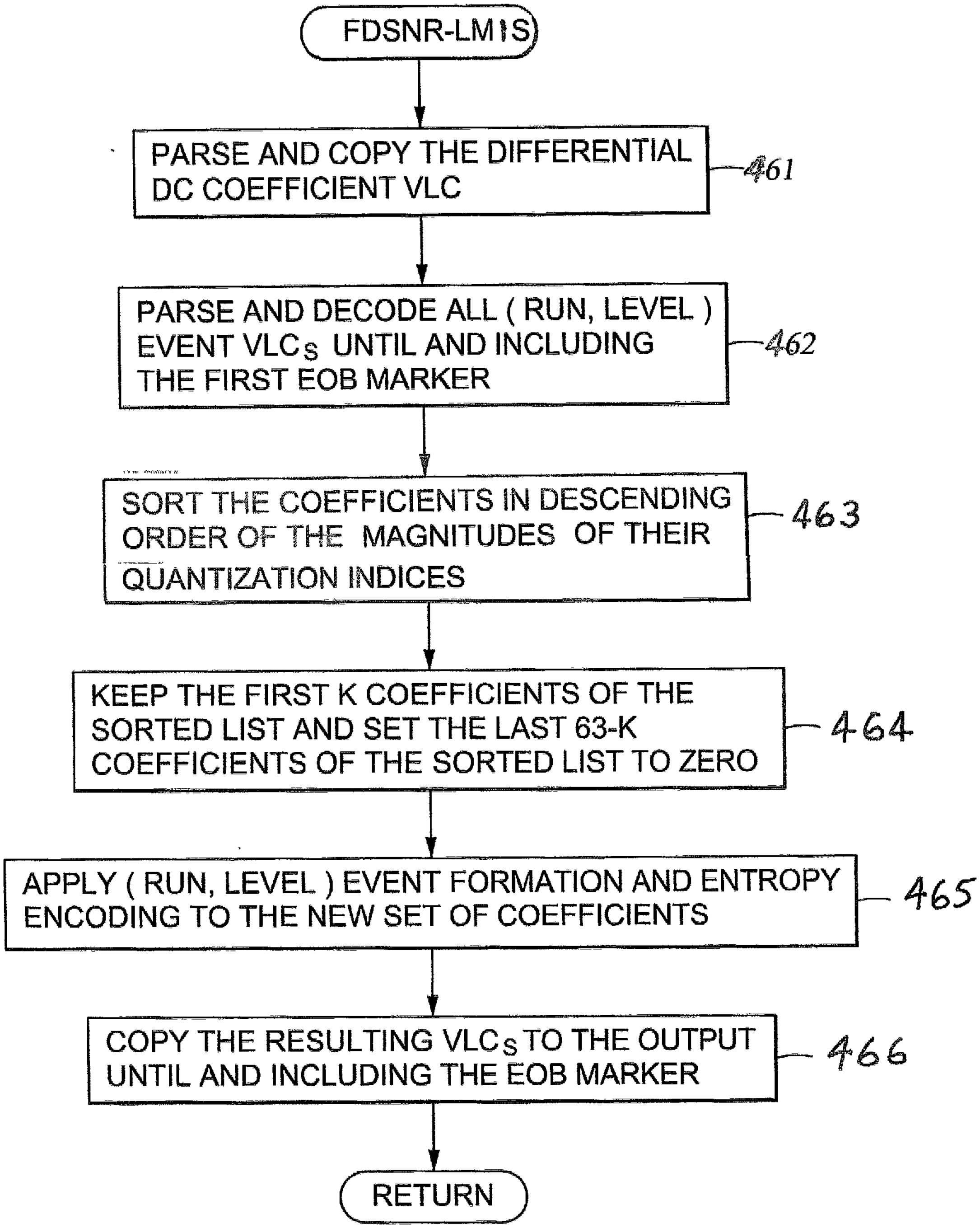

FDSNR-LMIS
PARSE AND COPY THE DIFFERENTIAL DC COEFFICIENT VLC
461
PARSE AND DECODE ALL (RUN, LEVEL) EVENT VLCS UNTIL AND INCLUDING THE FIRST EOB MARKER
462
SORT THE COEFFICIENTS IN DESCENDING ORDER OF THE MAGNITUDES OF THEIR QUANTIZATION INDICES
463
KEEP THE FIRST K COEFFICIENTS OF THE SORTED LIST AND SET THE LAST 63-K COEFFICIENTS OF THE SORTED LIST TO ZERO
464
APPLY (RUN, LEVEL) EVENT FORMATION AND ENTROPY ENCODING TO THE NEW SET OF COEFFICIENTS
465
COPY THE RESULTING VLCS TO THE OUTPUT UNTIL AND INCLUDING THE EOB MARKER
466
RETURN

FIG. 30

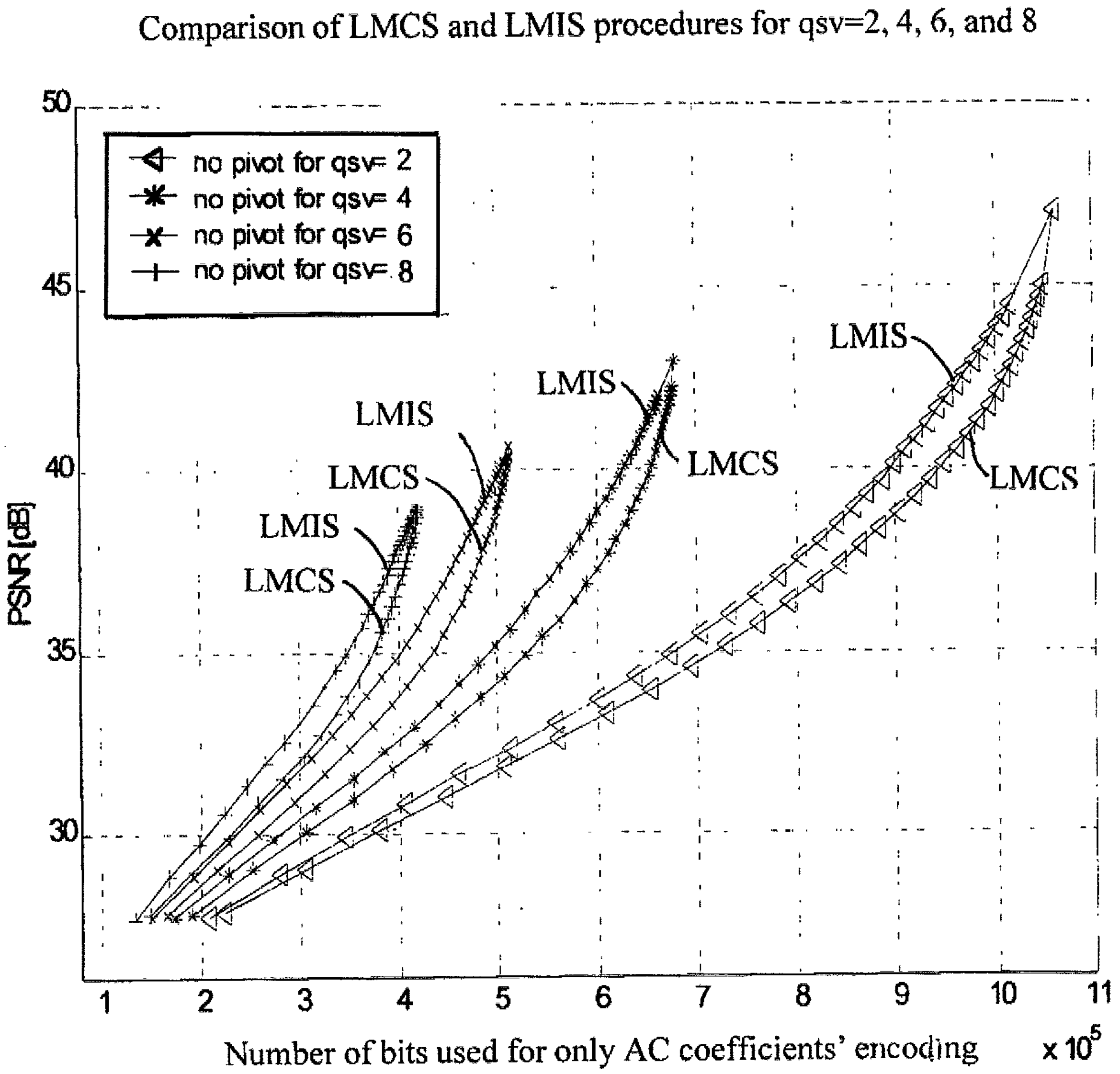

Comparison of LMCS and LMIS procedures for qsv=2, 4, 6, and 8
no pivot for qsv= 2
no pivot for qsv= 4
no pivot for qsv= 6
no pivot for qsv= 8
LMIS
LMCS
LMIS
LMCS
LMIS
LMCS
LMIS
LMCS
PSNR [dB]
50
45
40
35
30
1
2
3
4
5
6
7
8
9
10
11
Number of bits used for only AC coefficients' encoding
x 10^5

FIG. 31

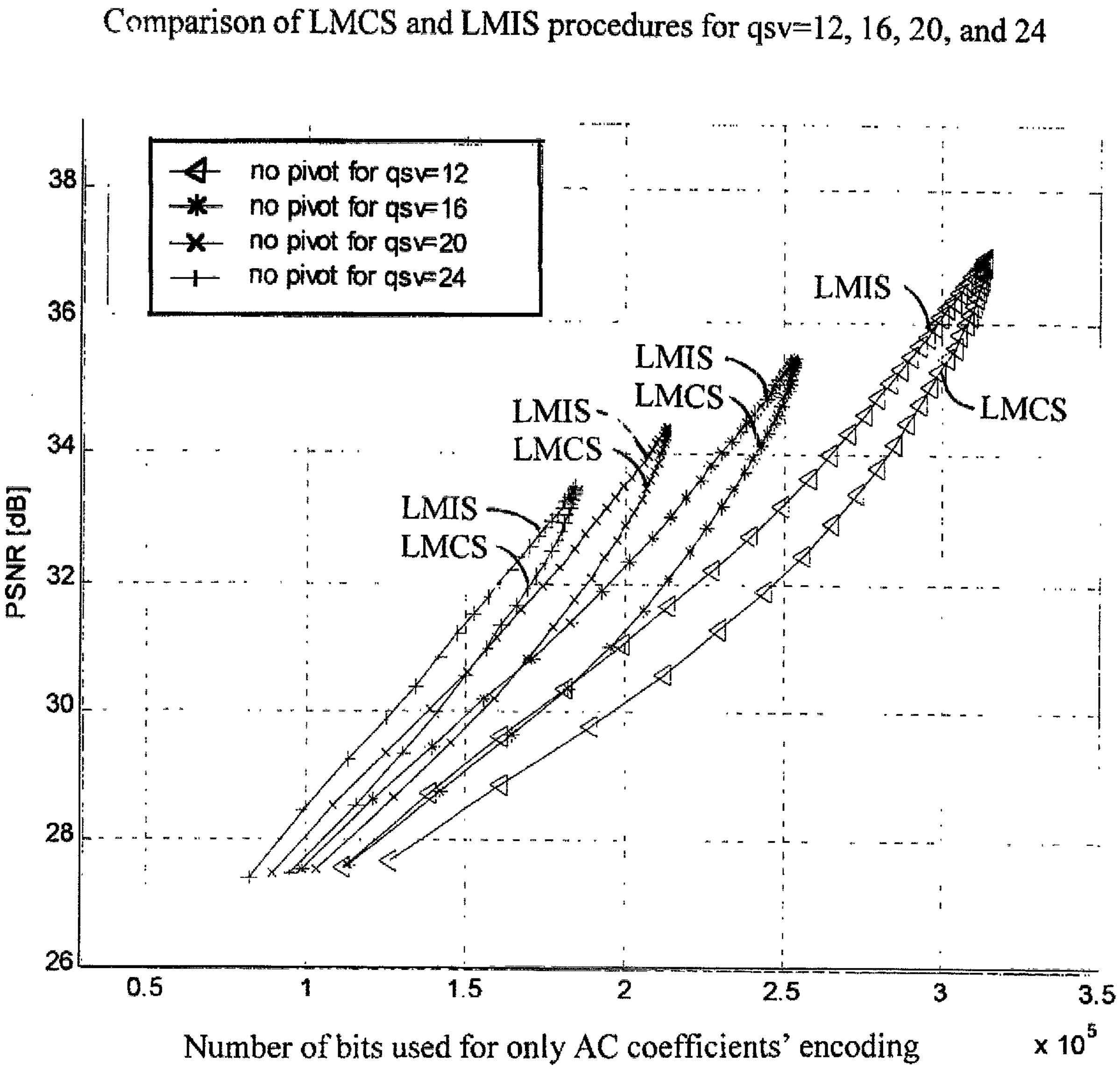

Comparison of LMCS and LMIS procedures for qsv=12, 16, 20, and 24

FIG. 32

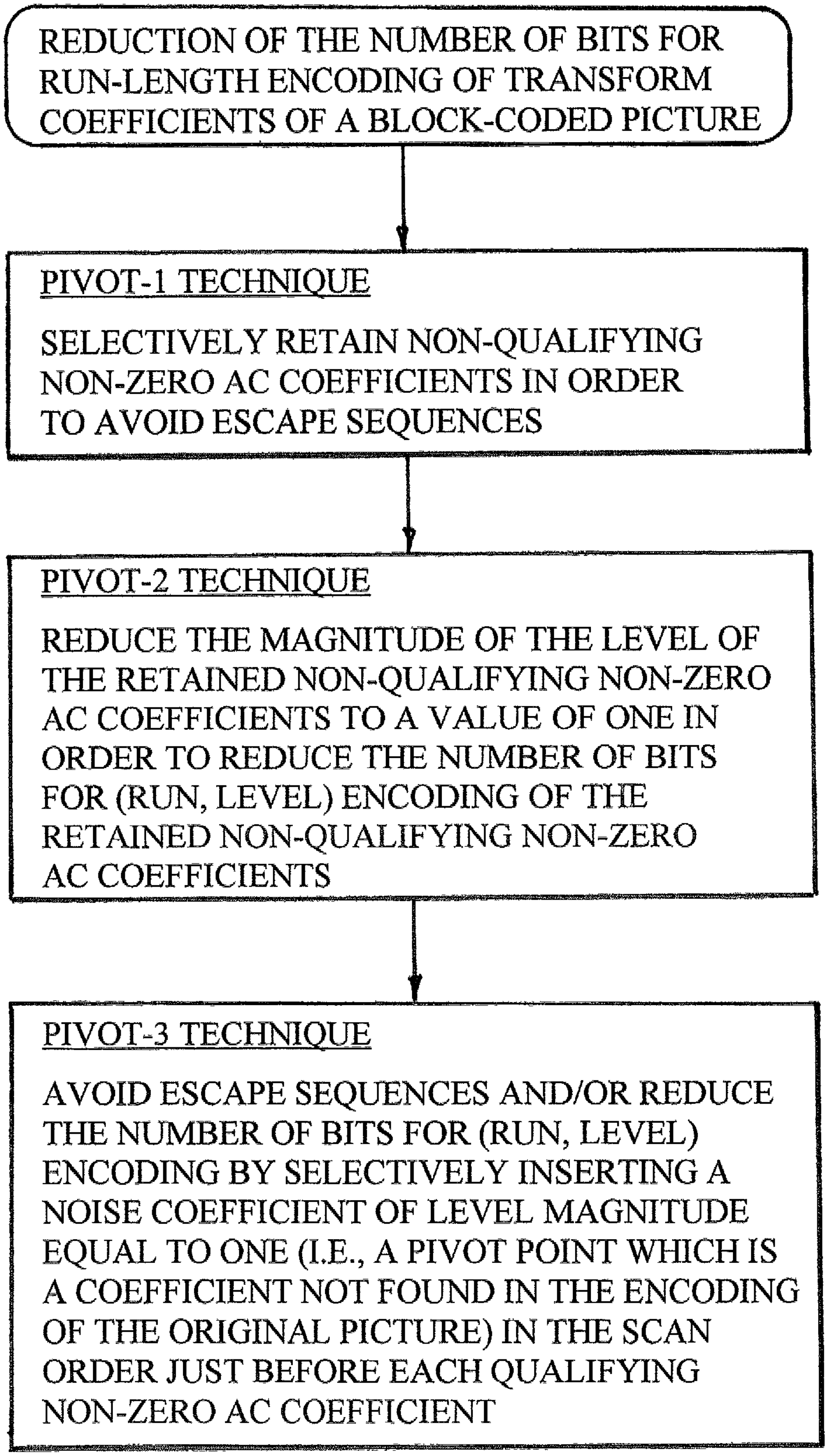

REDUCTION OF THE NUMBER OF BITS FOR RUN-LENGTH ENCODING OF TRANSFORM COEFFICIENTS OF A BLOCK-CODED PICTURE
PIVOT-1 TECHNIQUE
SELECTIVELY RETAIN NON-QUALIFYING NON-ZERO AC COEFFICIENTS IN ORDER TO AVOID ESCAPE SEQUENCES
PIVOT-2 TECHNIQUE
REDUCE THE MAGNITUDE OF THE LEVEL OF THE RETAINED NON-QUALIFYING NON-ZERO AC COEFFICIENTS TO A VALUE OF ONE IN ORDER TO REDUCE THE NUMBER OF BITS FOR (RUN, LEVEL) ENCODING OF THE RETAINED NON-QUALIFYING NON-ZERO AC COEFFICIENTS
PIVOT-3 TECHNIQUE
AVOID ESCAPE SEQUENCES AND/OR REDUCE THE NUMBER OF BITS FOR (RUN, LEVEL) ENCODING BY SELECTIVELY INSERTING A NOISE COEFFICIENT OF LEVEL MAGNITUDE EQUAL TO ONE (I.E., A PIVOT POINT WHICH IS A COEFFICIENT NOT FOUND IN THE ENCODING OF THE ORIGINAL PICTURE) IN THE SCAN ORDER JUST BEFORE EACH QUALIFYING NON-ZERO AC COEFFICIENT

FIG. 33

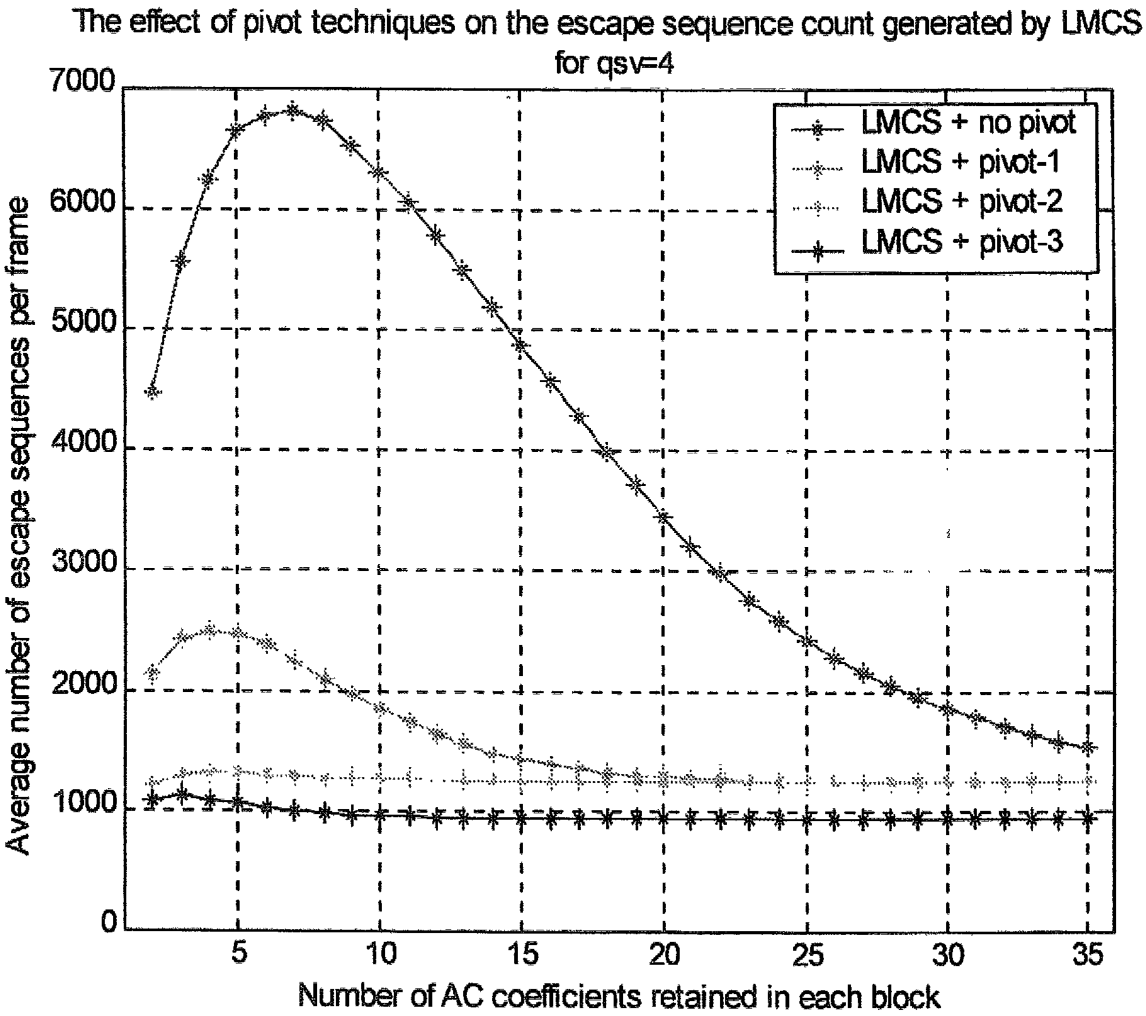

The effect of pivot techniques on the escape sequence count generated by LMCS for qsv=4
Average number of escape sequences per frame
7000
6000
5000
4000
3000
2000
1000
0
5
10
15
20
25
30
35
Number of AC coefficients retained in each block
LMCS + no pivot
LMCS + pivot-1
LMCS + pivot-2
LMCS + pivot-3

FIG. 34

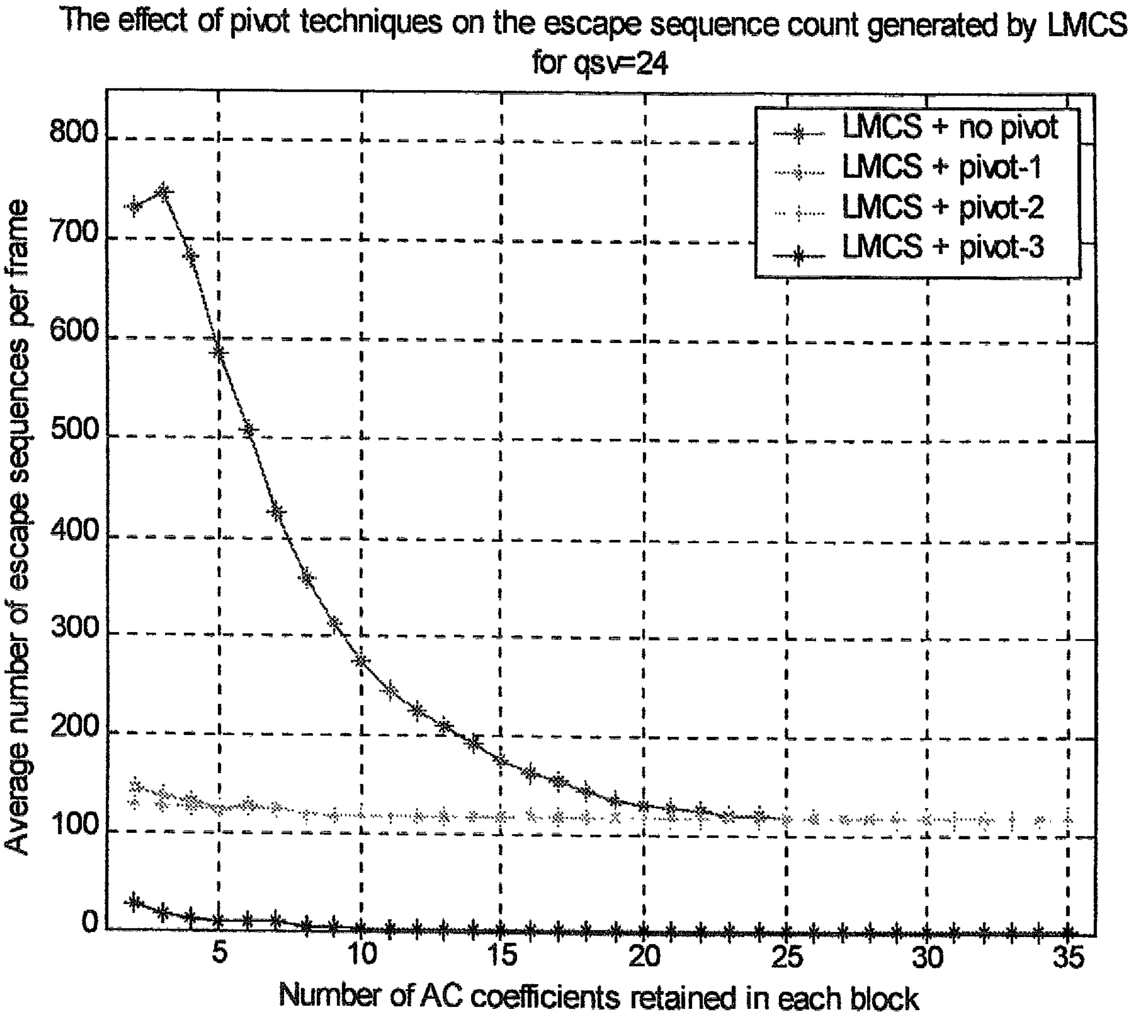

The effect of pivot techniques on the escape sequence count generated by LMCS for qsv=24

FIG. 35

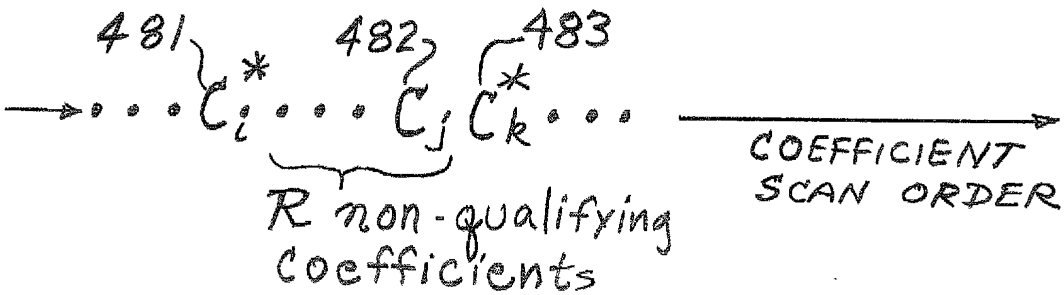

481
482
483
C_i^*
C_j
C_k^*
R non-qualifying coefficients
COEFFICIENT SCAN ORDER

FIG. 36

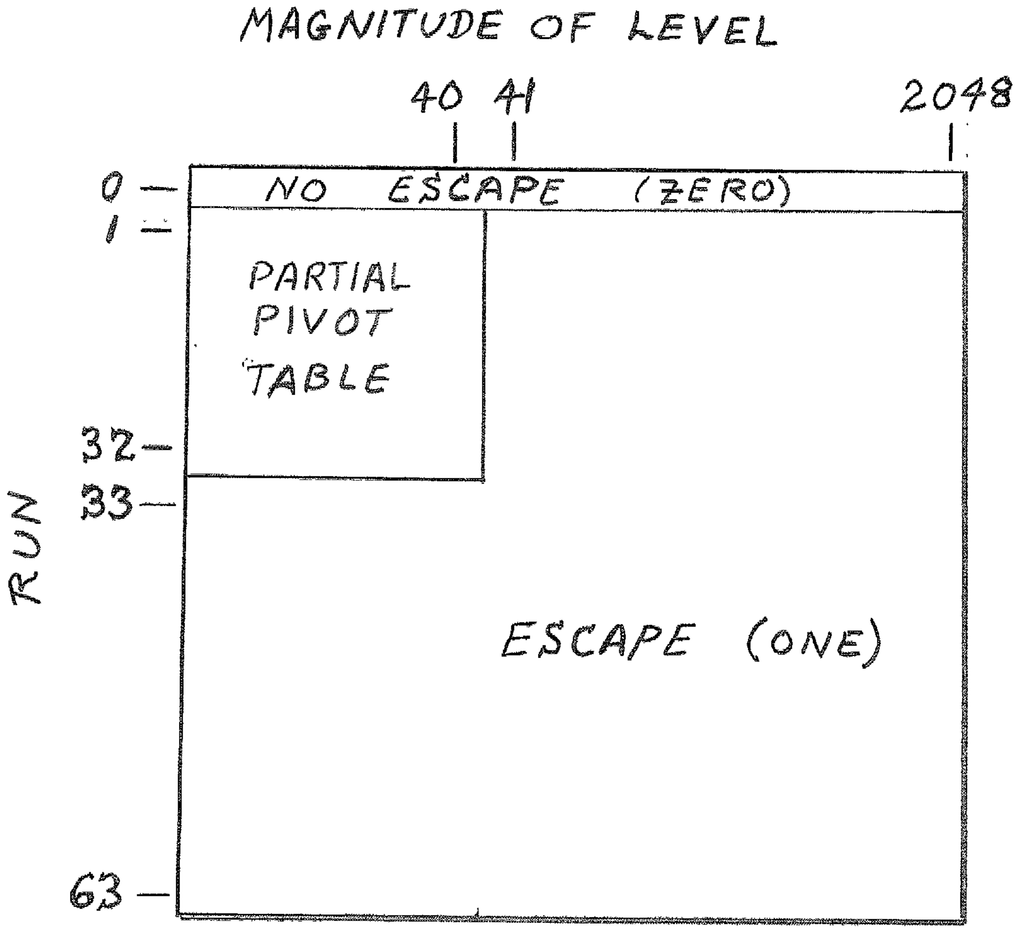
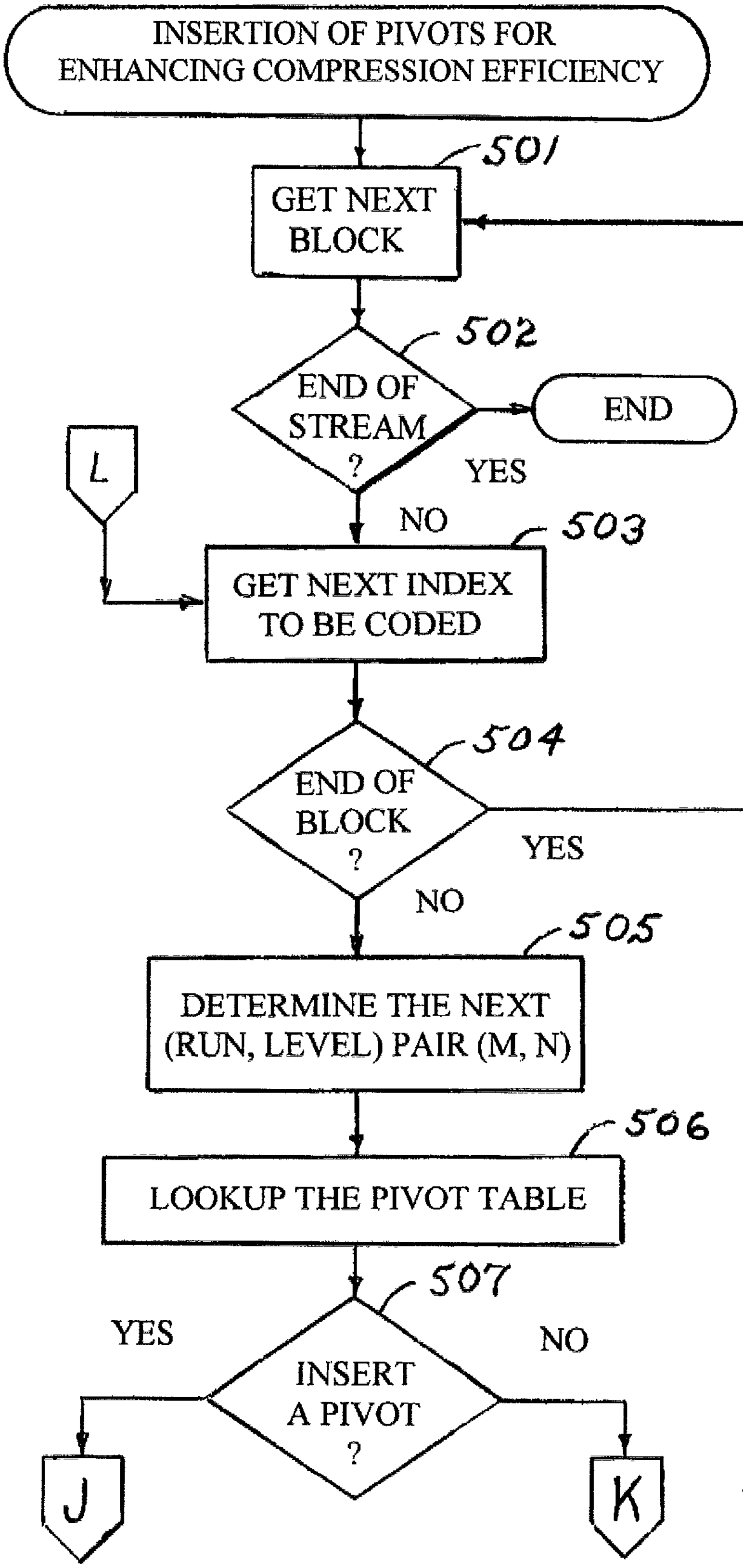

MAGNITUDE OF LEVEL
40
41
2048
0
1
32
33
63
RUN
NO ESCAPE (ZERO)
PARTIAL PIVOT TABLE
ESCAPE (ONE)

FIG. 37



INSERTION OF PIVOTS FOR ENHANCING COMPRESSION EFFICIENCY
501
GET NEXT BLOCK
502
END OF STREAM ?
END
YES
NO
L
503
GET NEXT INDEX TO BE CODED
504
END OF BLOCK ?
YES
NO
505
DETERMINE THE NEXT (RUN, LEVEL) PAIR (M, N)
506
LOOKUP THE PIVOT TABLE
507
YES
NO
INSERT A PIVOT ?
J
K

FIG. 38

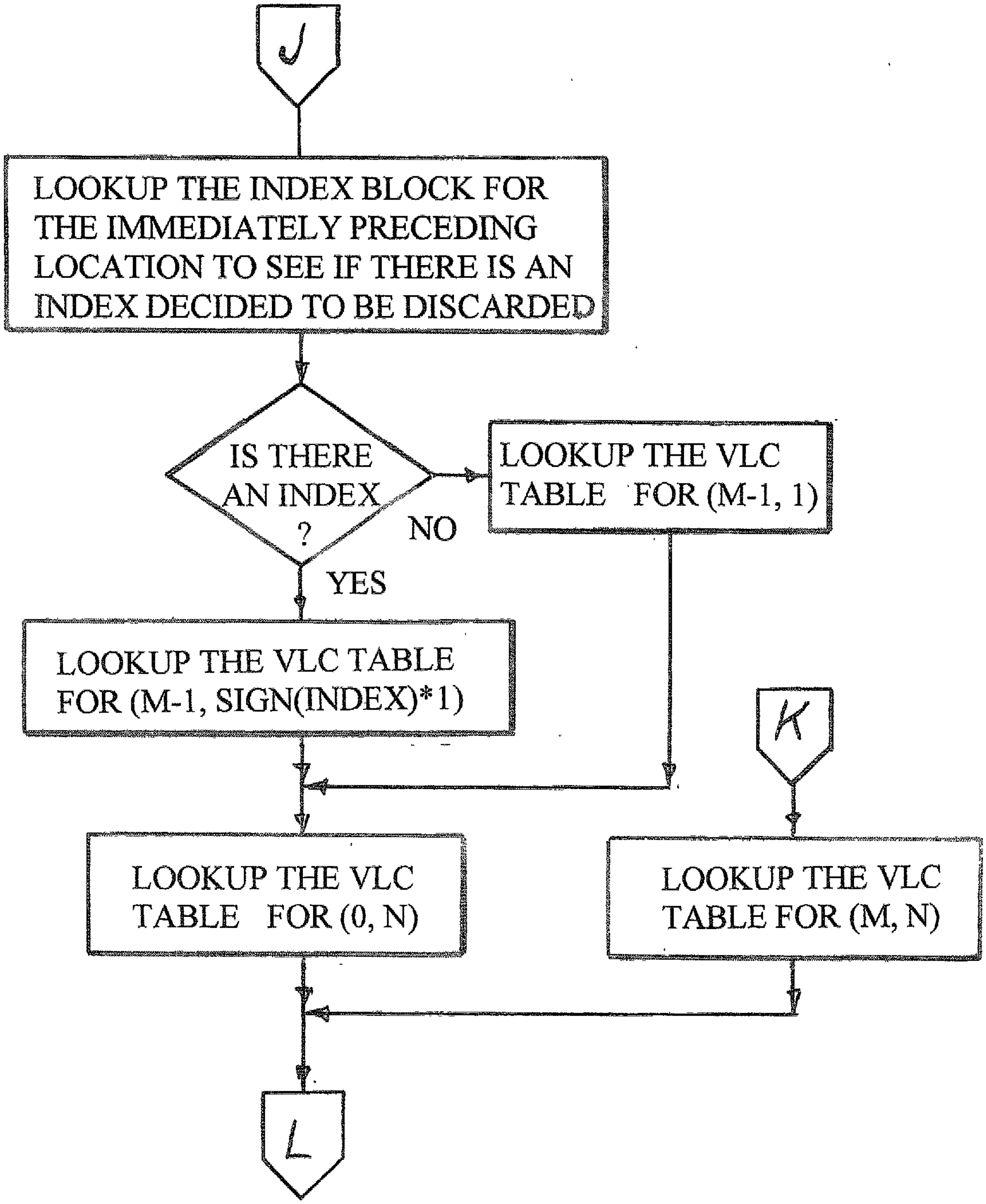

J
LOOKUP THE INDEX BLOCK FOR THE IMMEDIATELY PRECEDING LOCATION TO SEE IF THERE IS AN INDEX DECIDED TO BE DISCARDED
IS THERE AN INDEX ?
NO
LOOKUP THE VLC TABLE FOR (M-1, 1)
YES
LOOKUP THE VLC TABLE FOR (M-1, SIGN(INDEX)*1)
K
LOOKUP THE VLC TABLE FOR (0, N)
LOOKUP THE VLC TABLE FOR (M, N)
L

FIG. 39

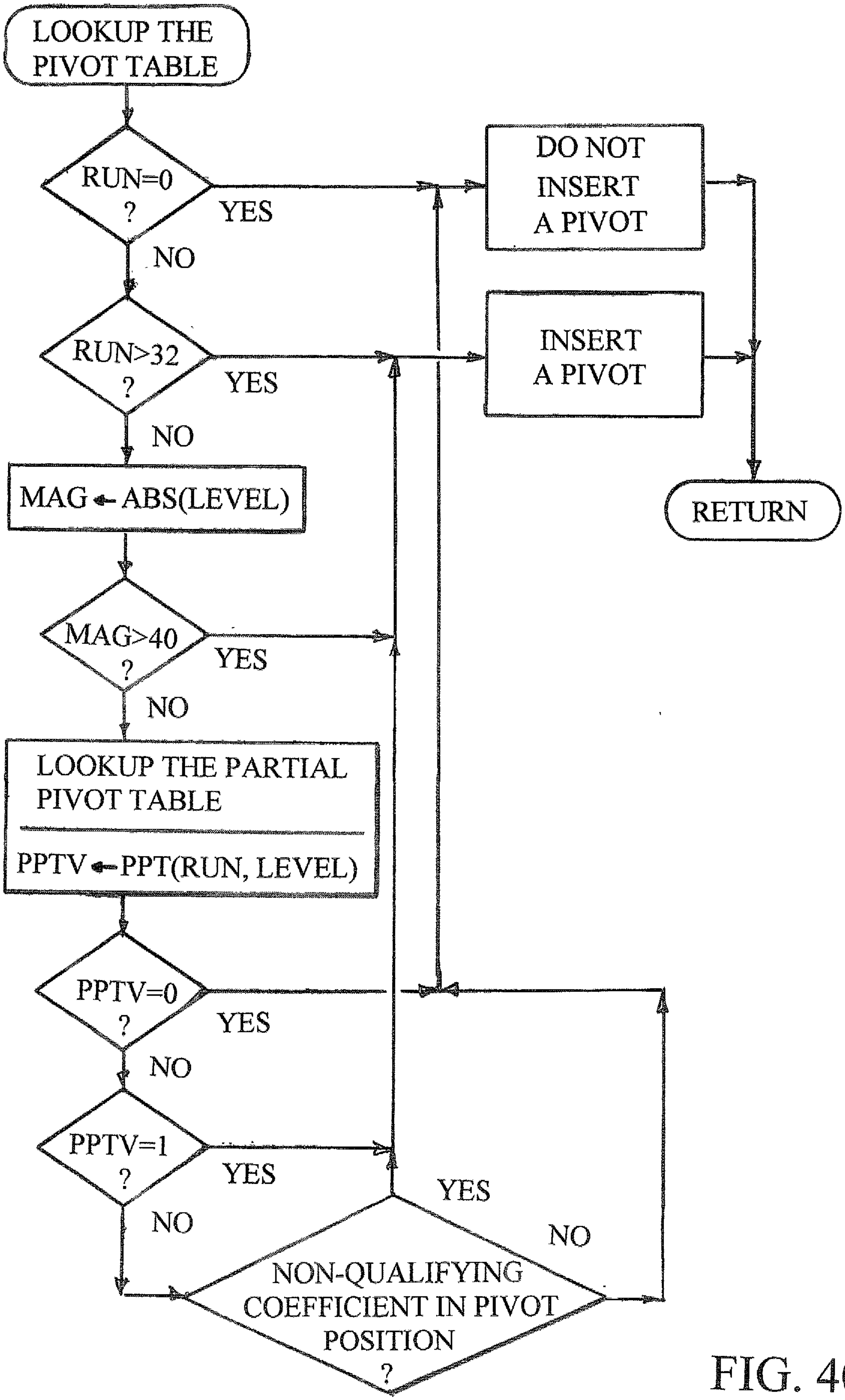

LOOKUP THE PIVOT TABLE
RUN=0 ?
YES
NO
DO NOT INSERT A PIVOT
RUN>32 ?
YES
NO
INSERT A PIVOT
RETURN
MAG ← ABS(LEVEL)
MAG>40 ?
YES
NO
LOOKUP THE PARTIAL PIVOT TABLE
PPTV ← PPT(RUN, LEVEL)
PPTV=0 ?
YES
NO
PPTV=1 ?
YES
NO
NON-QUALIFYING COEFFICIENT IN PIVOT POSITION ?
YES
NO

FIG. 40

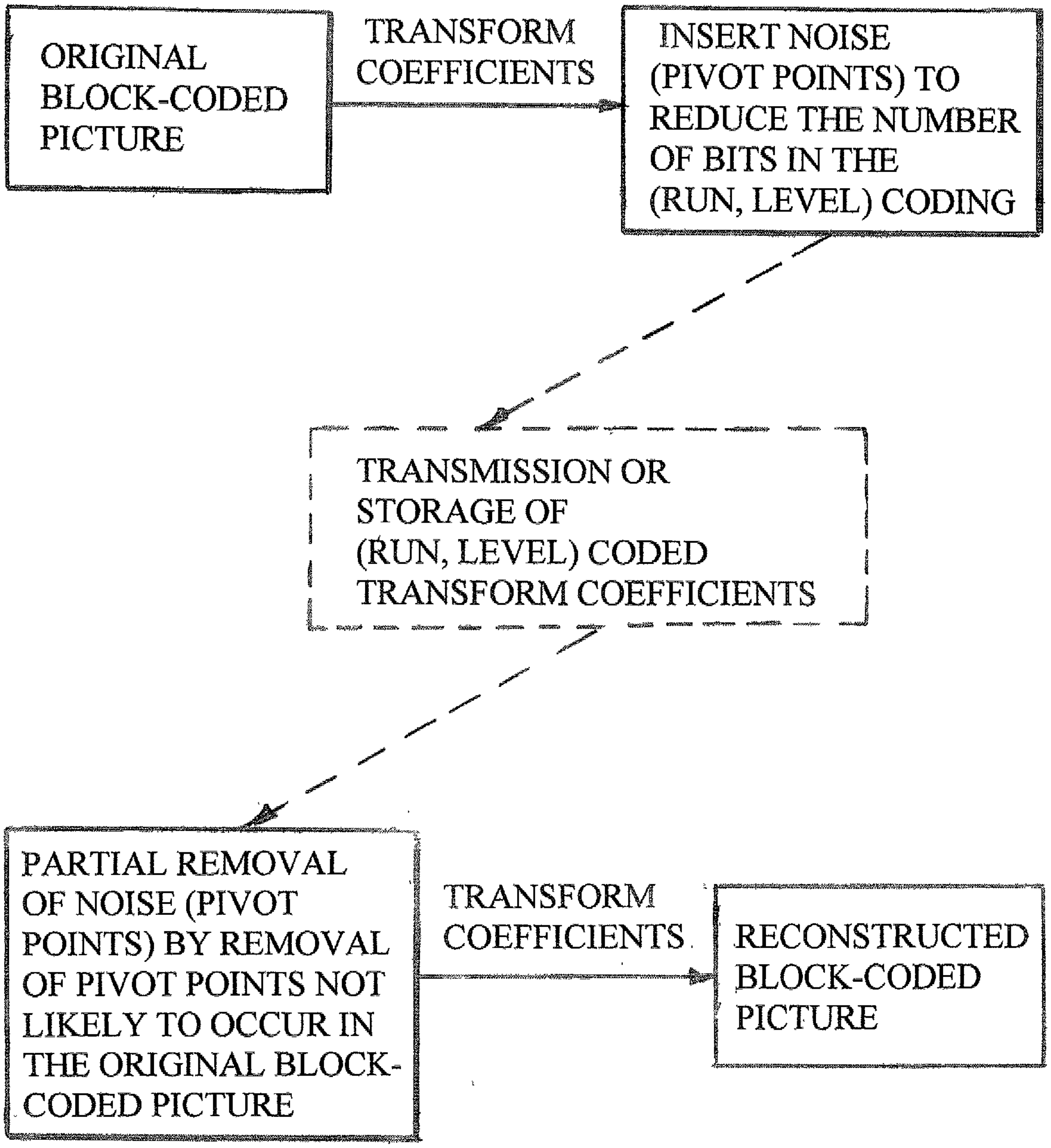

ORIGINAL BLOCK-CODED PICTURE
TRANSFORM COEFFICIENTS
INSERT NOISE (PIVOT POINTS) TO REDUCE THE NUMBER OF BITS IN THE (RUN, LEVEL) CODING
TRANSMISSION OR STORAGE OF (RUN, LEVEL) CODED TRANSFORM COEFFICIENTS
PARTIAL REMOVAL OF NOISE (PIVOT POINTS) BY REMOVAL OF PIVOT POINTS NOT LIKELY TO OCCUR IN THE ORIGINAL BLOCK-CODED PICTURE
TRANSFORM COEFFICIENTS
RECONSTRUCTED BLOCK-CODED PICTURE

FIG. 41

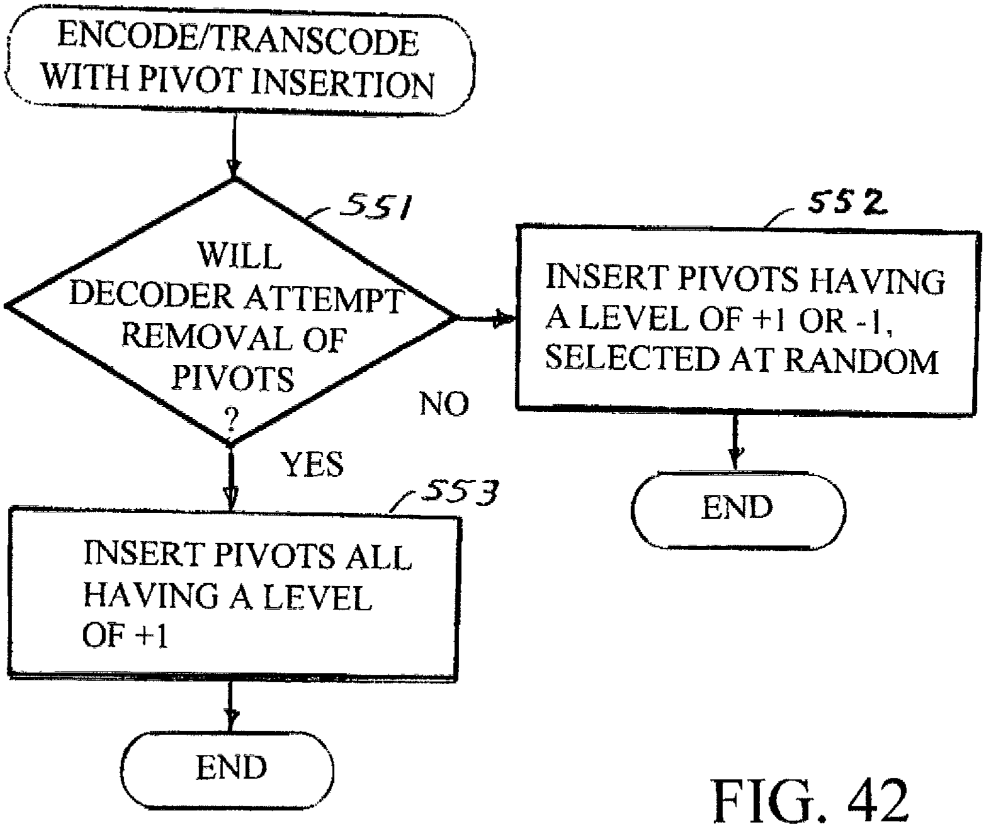

ENCODE/TRANSCODE WITH PIVOT INSERTION
551
WILL DECODER ATTEMPT REMOVAL OF PIVOTS ?
NO
YES
552
INSERT PIVOTS HAVING A LEVEL OF +1 OR -1, SELECTED AT RANDOM
END
553
INSERT PIVOTS ALL HAVING A LEVEL OF +1
END

FIG. 42

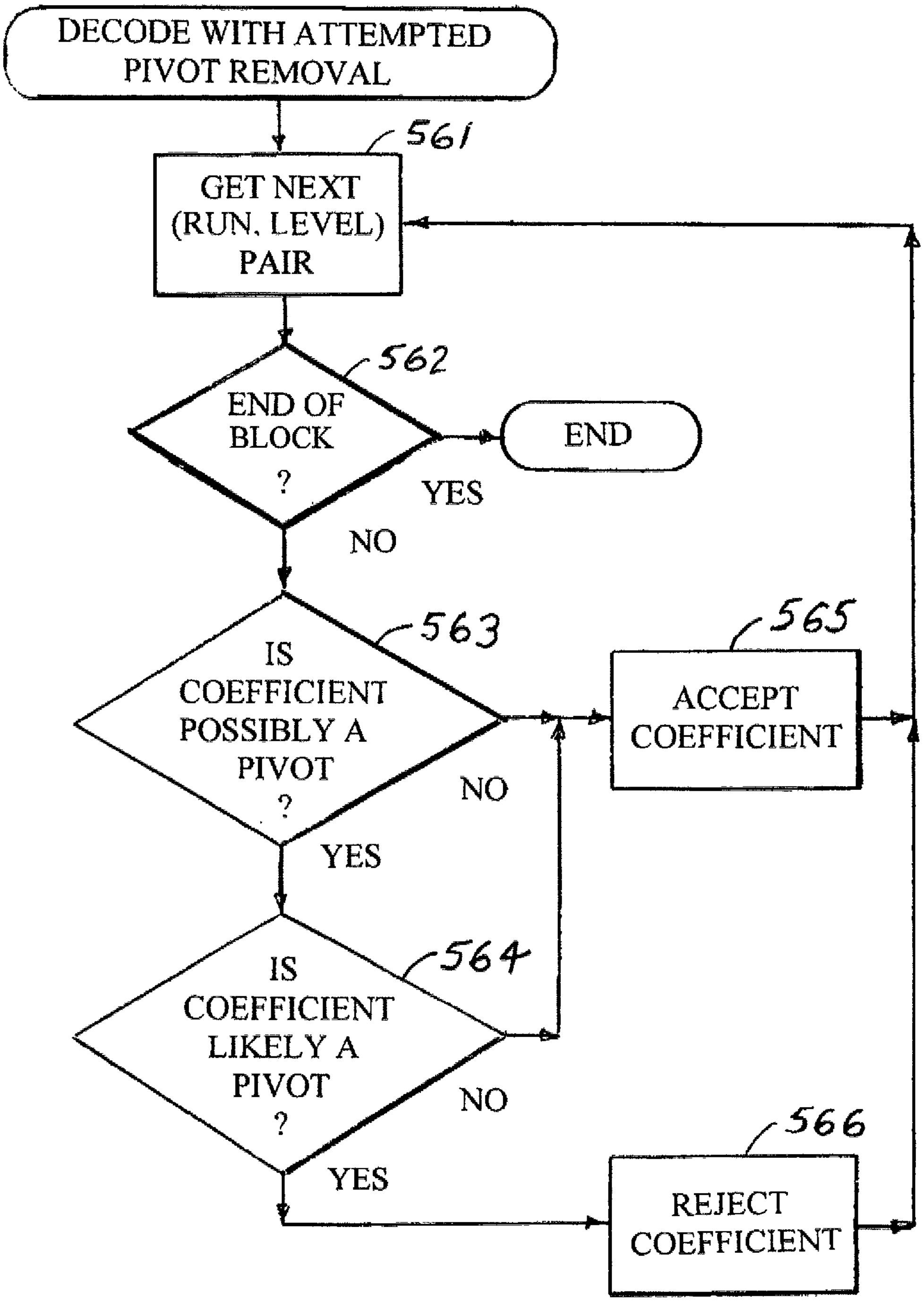

DECODE WITH ATTEMPTED PIVOT REMOVAL
561
GET NEXT (RUN, LEVEL) PAIR
562
END OF BLOCK ?
YES
END
NO
563
IS COEFFICIENT POSSIBLY A PIVOT ?
NO
YES
565
ACCEPT COEFFICIENT
564
IS COEFFICIENT LIKELY A PIVOT ?
NO
YES
566
REJECT COEFFICIENT

FIG. 43

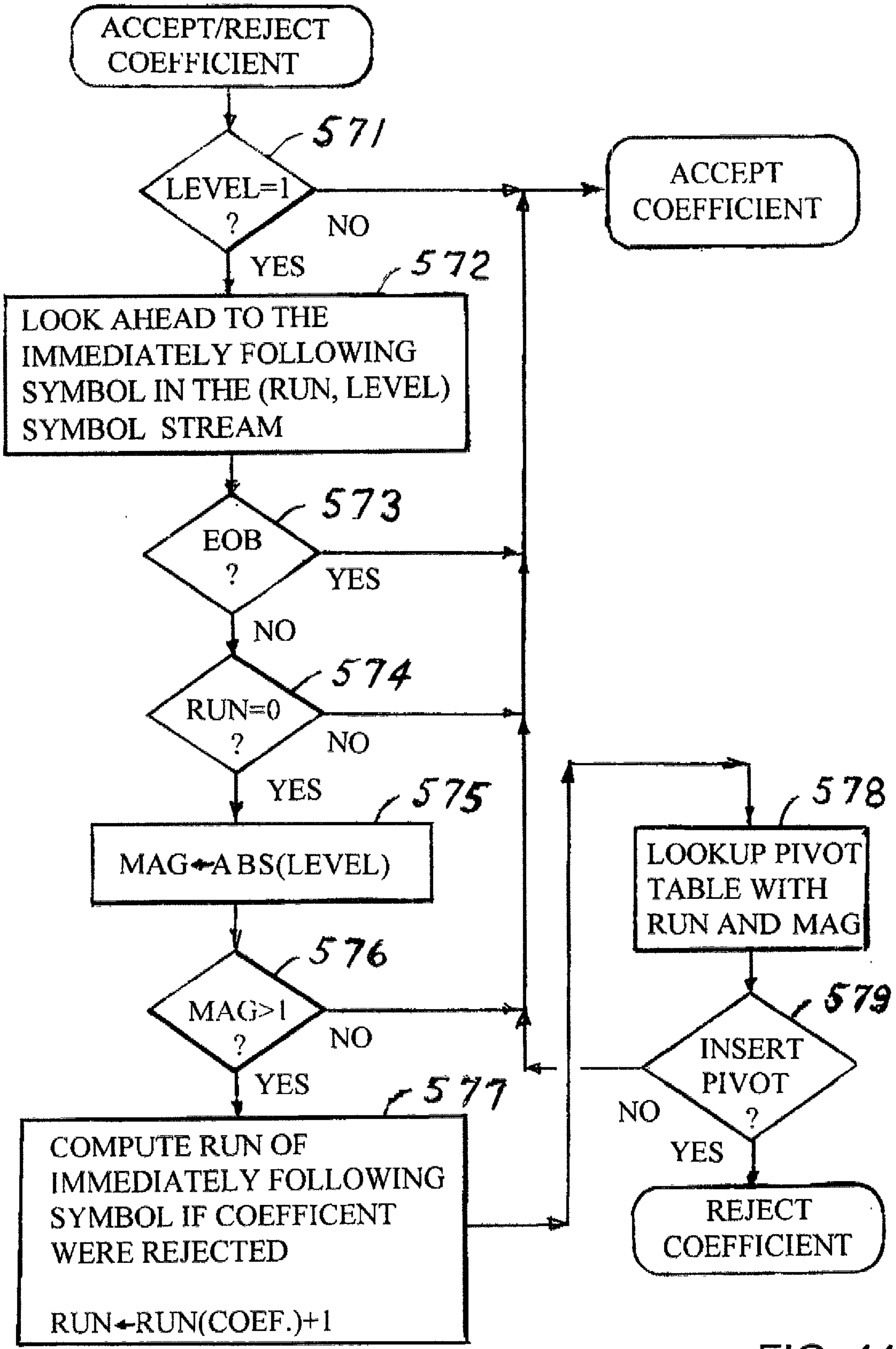

ACCEPT/REJECT COEFFICIENT
571
LEVEL=1 ?
NO
YES
ACCEPT COEFFICIENT
572
LOOK AHEAD TO THE IMMEDIATELY FOLLOWING SYMBOL IN THE (RUN, LEVEL) SYMBOL STREAM
573
EOB ?
YES
NO
574
RUN=0 ?
NO
YES
575
MAG←ABS(LEVEL)
576
MAG>1 ?
NO
YES
577
COMPUTE RUN OF IMMEDIATELY FOLLOWING SYMBOL IF COEFFICENT WERE REJECTED
RUN←RUN(COEF.)+1
578
LOOKUP PIVOT TABLE WITH RUN AND MAG
579
INSERT PIVOT ?
NO
YES
REJECT COEFFICIENT

FIG. 44

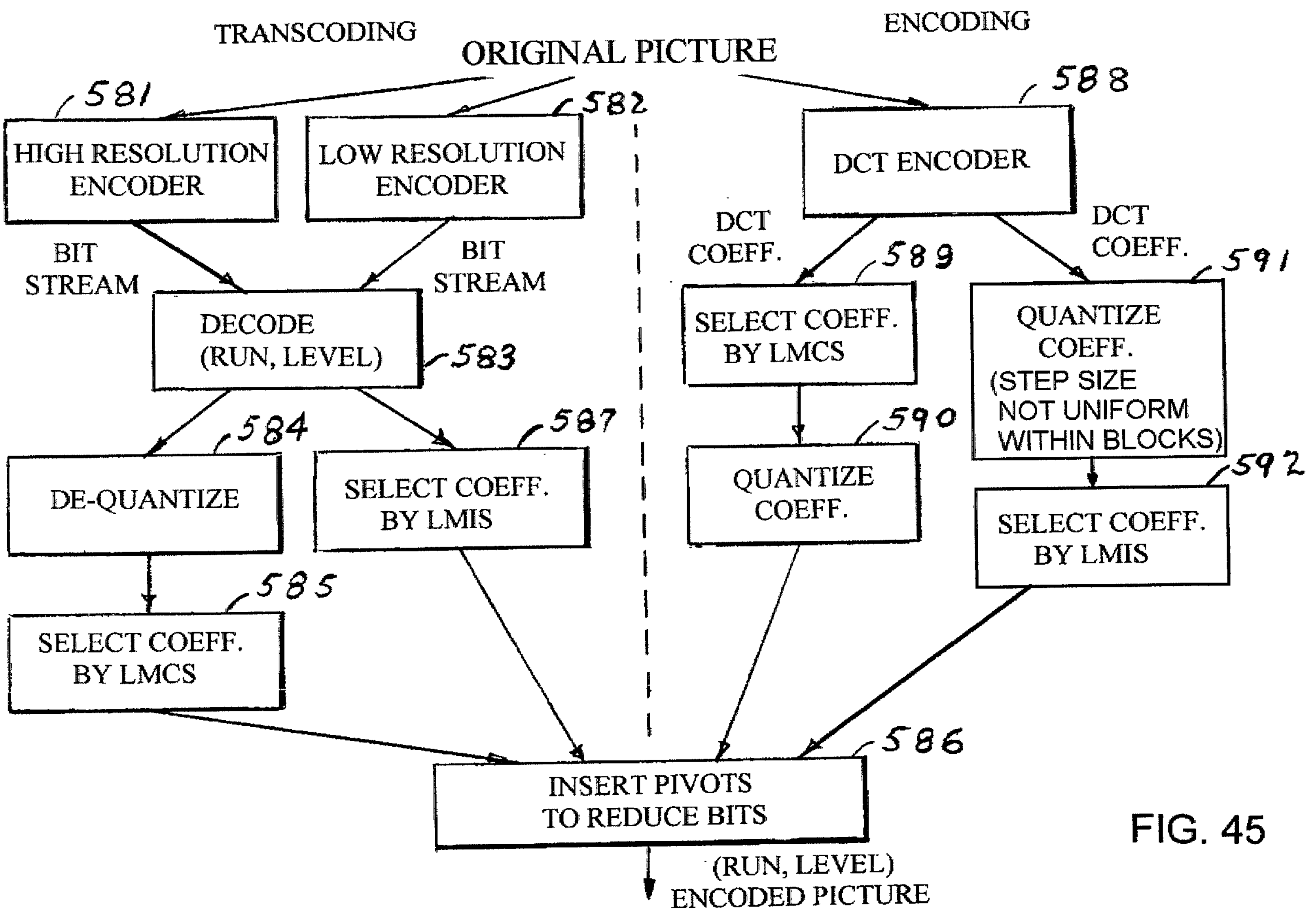

TRANSCODING
ORIGINAL PICTURE
ENCODING
581
HIGH RESOLUTION ENCODER
582
LOW RESOLUTION ENCODER
BIT STREAM
BIT STREAM
DECODE (RUN, LEVEL)
583
584
DE-QUANTIZE
587
SELECT COEFF. BY LMIS
585
SELECT COEFF. BY LMCS
588
DCT ENCODER
DCT COEFF.
DCT COEFF.
589
SELECT COEFF. BY LMCS
590
QUANTIZE COEFF.
591
QUANTIZE COEFF. (STEP SIZE NOT UNIFORM WITHIN BLOCKS)
592
SELECT COEFF. BY LMIS
586
INSERT PIVOTS TO REDUCE BITS
(RUN, LEVEL) ENCODED PICTURE

FIG. 45